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EDITORIAL STATEMENT

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The Editors believe that relevant contributions can come from experimental studies as well as from clinical ones, from controlled developmental studies as well as from the genetic explorations of psychoanalytic therapy, and that investigations carried out without any concern for psychoanalysis may nevertheless contribute to the theory. In
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PSYCHOLOGICAL ISSUES

VOL. II, No. 3 1960 MONOGRAPH 7

PRECONSCIOUS STIMULATION IN DREAMS, ASSOCIATIONS, AND IMAGES

Classical Studies

by

OTTO PÖTZL, RUDOLF ALLERS and JAKOB TELER

Introduction by

CHARLES FISHER

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POLICY ANNOUNCEMENT

Psychological Issues' declared purpose of publishing four monographs in a calendar year has proved to be unrealistic. The mechanics of processing long manuscripts, each posing different problems for the careful editing to which all monographs without exception are subjected, and the rewriting required in some instances, have made it difficult to adhere to the standard journal practice of a fixed publication date.

Rather than retreat from its editorial standards to conform to the four-issues-per-year policy, *Psychological Issues* has decided to make its publication dates more flexible. It will issue its unit of four monographs over an eighteen-month period without changing its subscription policy: the subscription rate will continue to cover four issues. For bibliographic listings, the four monographs will be dated within the same calendar year.

It is our hope that this change will reduce the instances of an announced publication date proving unreliable, with its inconvenience to readers and embarrassment to the editors. For earlier such instances we offer sincere apologies.

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A NOTE ON THE TRANSLATIONS

Certain decisions that were made in preparing the translations should be briefly described.

The desirability of translating "verbatim" reports as precisely as possible is obvious, but the difficulties and disadvantages of doing so are equally obvious, and are, in Pötzl's case, compounded by the uncolloquial sound of the original German. An idiomatic rendering may distort meaning and sacrifice nuance; a literal rendering may, in the name of scholarship, result in noticeably eccentric English. We have tried to steer a middle course between these dangers.

Unusual difficulties arose in the translation of Pötzl. In the experiments he describes, Pötzl was working in a borderline field, dealing with material and ideas for which no adequate terminology existed, and he drew upon an extraordinary variety of fields for analogues and vocabulary. Unfortunately, he does not appear to have been consistent in his use of terms, nor entirely felicitous in his choice of them. Because the contexts seemed to make it obligatory, we have sometimes translated the same German word into different English words. Thus *optische* is usually "visual" but occasionally "optical"; *geometrisch* usually "spatial" but occasionally "geometric"; *Gestalt* usually "form" but occasionally "Gestalt." Sometimes, when meaning and intention are quite clear, it is apparent that his usage is worse than inconsistent. *Horizontalmeridian,* for example, is probably unacceptable German; a literal translation is certainly unacceptable English. In this case, however, since there is no correct English term for the idea he is trying to express, the literal translation, "horizontal meridian," has been made.

Similar difficulties are apparent even in simple descriptions: for example, in the terms used to describe the ships in Experiment II.

Here, the translation is rather free, since a literal one, at obvious variance with accepted English usage, would serve no purpose.

A few passages, for the most part brief, in which Pötzl attempts to put his findings into the frameworks of mathematics and physics, have been omitted from the translation, since it seemed impossible to render them intelligibly.

We were unable to trace some of Pötzl's more obscure references to medicine and psychology. It can only be hoped that such literal translations as "the Liepmann-Kalmus separation error" are not grossly misleading.

Throughout, Pötzl's impersonal designation of himself as "the author" has been changed, in the interests of simplicity, to "I."

All additions to the original text are enclosed in brackets.

All references have been checked. A few, which could not be verified in spite of diligent search, are listed in the bibliography just as they appeared originally.

Joan Wolff
David Rapaport
Suzette H. Annin

ACKNOWLEDGMENTS

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Grateful acknowledgment is made to Dr. Ernest R. Hilgard for permission to consult translations of the Pötzl and Allers and Teler papers prepared by Ruth Ohlin for The Laboratory of Human Development, Stanford University, and for permission to reproduce photographs made at Stanford of the illustrations which accompany the Pötzl paper.

Grateful acknowledgment is made to Joan Wolff for her successful efforts to obtain the print of *The Presentation of Mary* from which the drawing on p. 125 was made.

INTRODUCTION

CHARLES FISHER, M.D.

We are indebted to Mrs. Joan Wolff, Miss Suzette Annin, and Dr. David Rapaport for bringing out these excellent English translations of the classic papers by Pötzl and by Allers and Teler. It is only within the last six or seven years that renewed interest in these works, so long buried in oblivion, has been aroused among experimental psychologists and psychoanalysts. The reasons for this neglect are several. Although Freud knew of Pötzl's work, which had been presented to the Vienna Psychoanalytic Society in 1917, praised the method and the findings, and spoke of the wealth of implications that went far beyond the sphere of dream interpretation (see Freud, 1900, pp. 181-182; footnote added in 1919), psychoanalysts paid little attention to it, and its implications for psychoanalytic theory were not followed up. This was partly because the work was experimental in nature and, therefore, not especially congenial to the clinical orientation of most analysts. In part, however, the extreme unreadability of the article in the original German and the absence of an adequate English translation contributed to the neglect. There is no doubt that Pötzl's paper nearly defies translation and is extremely difficult to comprehend in the original even by those whose native tongue is German. Pötzl wrote in one of the most turgid and tormented styles ever to flow from the pen of man. The difficulty of his style is equalled by the obscurity of his thought. He had an analogizing and generalizing tendency, an ability to note relationships among seemingly diverse phenomena that was both his special gift and his readers' curse. This talent for synthesis is responsible for much that is valuable in his work, but often it gets out of hand and runs riot in overimaginative analogies that at times border on the mystical. There are frequent attempts to draw parallels between the sensoriphysiological processes involved in the dream and its psychological content, often ingenious but not always convincing.

But in spite of all this, the fact remains that Pötzl's basic experiment was brilliant in its conception and yielded a solid core of observations that the recent work of a number of investigators has confirmed. Moreover, there is no doubt that the most important reason for the neglect of Pötzl's work was that he was far ahead of his time. It was his feeling that he had created a number of bridges linking sensory physiology, psychoanalysis, experimental psychology, and neurophysiology. More than forty years later we can begin to see how prophetic his vision was. In recent years a number of experimentally minded psychoanalysts and analytically trained experimental psychologists have shown renewed interest in Pötzl's findings. The bridge to neurophysiology that Pötzl spoke of has begun to gain a solid foundation in the work on the ascending and descending reticular systems and their relationships to the functions of arousal, wakefulness, sleep, attention, and perception. The recent investigations of Dement and Kleitman (1957), and Dement (1960), have provided a neurophysiological correlate of dreaming. These investigators have even provided a kind of confirmation of one of Pötzl's most dubious propositions, i.e., that incipient eye movements play an important role in dream formation, by demonstrating that dreaming is actually accompanied by rapid vertical and horizontal eye movements.

The rather extensive body of experimental work of the past six years inspired by Pötzl's findings will be listed and briefly summarized below. Before doing this, however, a detailed summary of Pötzl's experimental findings, theoretical formulations and conclusions will be presented in order to assist the reader.

SUMMARY OF PAPER BY PÖTZL

One of the factors that makes Pötzl's analysis and discussion of the individual experiments so difficult to comprehend and so obscure is that a first, briefer discussion is followed by a second, much longer one, revolving around a "photographic" analysis of the sensoriphysiological processes involved in each experiment. Theoretical comment and discussion are scattered indiscriminately throughout the presentation of results. The paper is endlessly repetitious and many of the concepts introduced are discussed three or four times. In addition, there are many errors and contradictions in the presentation and discussion of the experimental data.

Pötzl's basic tachistoscopic dream experiment grew out of a series of observations made on patients with visual disturbances due to brain injuries. These findings were related to observations that had been made on the effects of fleeting visual stimuli in studies on afterimages by nineteenth-century investigators. The starting point for the entire investigation, according to Pötzl, was Helmholtz's finding that visual stimuli not consciously perceived during the original viewing of the stimulus object appeared in afterimages. Purkinje noted the same phenomena in hypnagogic imagery, and Johannes Müller in the so-called subjective visual phenomena. Urbantschitsch (1907) also demonstrated that unnoticed registrations appear in subsequent eidetic images. These registrations appeared after a temporal delay, in a rhythmic periodic manner, accompanied by transformations, e.g., condensations, fragmentations, displacements, rotations, etc., similar to those found in dreams.

Pötzl begins his discussion with a consideration of certain visual disturbances resulting from gunshot injuries to the occipital lobe. Following such injuries, physiological double images (diplopia) may enter consciousness, and the patient may become aware of impressions which originate in indirect vision, or perceive the blind spot during perimetry. He suggests that these are release phenomena, brought about by the occipital brain injury and resulting in a disturbance of what he called an "abstracting process." The "abstracting process" normally exerts an inhibiting influence and prevents the phenomena noted above, i.e., diplopia, impressions which originate in indirect vision, etc., from attaining consciousness.

He is especially interested in the relationships between central and peripheral vision; he believes that the processes which arise in peripheral vision are normally excluded from consciousness. Pötzl discusses in detail a rare case, a patient (Obszut) with an occipital gunshot wound, who had a total lesion of central direct vision with preservation of peripheral vision. In such patients, with time, peripheral (indirect) vision can attain the levels of performance of central vision, but in the early stages of the disturbance certain interesting phenomena can be observed. For example, Obszut showed a conspicuous, peculiar form of vision that consisted of spatially and temporally completely separated fragments of impressions which emerged into consciousness in a delayed and piecemeal way. An example of this is the following. The patient was shown a bouquet of roses from which a stalk of asparagus projected in a conspicuous fashion. He consciously perceived only the red roses. Evidently, the percept of the stalk of asparagus did not emerge into consciousness. The bouquet was removed and the patient was asked to identify the regimental color on the collar of an officer who was present in the room. The patient made labored focusing movements in order to bring the object into his residual visual field. He then stated that he saw a "green tiepin." The implication here is that the stalk of asparagus not noted on exposure of the bouquet was unconsciously registered and then emerged into consciousness after a delay but transformed into a green tiepin. There is the further implication that the patient did not perceive the actual regimental color on the officer's collar but saw the green tiepin instead. According to Pötzl, such delayed form impressions undergo condensations, displacements, rotations, and other kinds of transformations in the same manner as do dream images. This patient, at this stage of his recovery, showed the delayed piecemeal delivery into consciousness of successive fragments of the originally exposed stimulus, such as the bouquet of flowers, seen in indirect vision. At a later stage of recovery, indirect vision functions in the same manner as the direct vision of normals, i.e., perceived objects such as the bouquet do not attain consciousness in a delayed manner in *successive* fragments, but all parts are consciously perceived *simultaneously* in a unified form.

Another example of the phenomenon of stimuli not consciously perceived at the moment of exposure, but appearing in consciousness in the delayed manner noted above, is the following: Pötzl (1915) tachistoscopically exposed pictures to a patient with a latent hemianopsia and alcoholic hallucinosis, who was hallucinating at the time of the experiment. Those parts of the pictures not noted at the time of exposure appeared in the patient's hallucinations as a discontinuous series of single images. In several hundred trials, the parts of the tachistoscopically exposed pictures which were not consciously noted appeared in the contents of subsequent hallucinations; the parts that were noted were strictly excluded. Each single hallucination corresponded to a small portion of the exposed stimulus picture, and showed characteristics of dream images such as condensations, displacements, mirror images, and spatial transpositions. Pötzl also introduced tachistoscopic stimuli exclusively into the indirect visual fields of this patient by means of a perimetric setup and found that parts of the stimulus picture again appeared in the hallucinations. He believes that this patient, like Obszut, showed a general disturbance of the "process of abstracting." He concludes that percepts originating in indirect vision can emerge into hallucinations with full sensory clarity of form as a succession of delayed and piecemeal fragments.

Pötzl conceived his dream experiment on the basis of the following considerations. He postulated that the above-described phenomena occur in normal people but do not attain consciousness because the "abstracting process" has a suppressing effect. They are, therefore, release phenomena resulting from a disturbance of the "abstracting process." It occurred to him that there exists a condition, namely, the dream, in which the abstracting process is normally in abeyance. He decided to test experimentally the proposition that the above-described visual developments could be detected in dream formation.

Experimental Method: Twelve male and female subjects were used; they were naïve about Freudian dream theory and were kept in ignorance of the nature of the experiment. A simple camera-shutter type of tachistoscope was used for exposing stimulus pictures at speeds of $\frac{1}{100}$ second. The stimulus pictures were colored slides of street scenes or landscapes. Neither the experimenter nor the subjects were permitted a full view of the pictures until the end of the experiment. Following tachistoscopic exposure, the subject was required to describe and draw what he had seen. He was then instructed to make a written record of any dreams he had during the following night. The next day he reported the dream to the experimenter and made drawings of his dream images. The stimulus picture was then exposed for a prolonged period while the subject searched for correspondences between the drawings of his dream images and elements of the stimulus picture.

Results: The greater part of the paper is taken up with a painfully detailed presentation, analysis, and discussion of the results of four representative experiments, each demonstrating a different aspect of the phenomena. The first experiment showed that after tachistoscopic exposure there was a delayed delivery into consciousness (in the dream that occurred hours after exposure) of parts of the stimulus picture which had not been consciously perceived. Only parts of the stimulus picture that were not noted appeared in subsequent dreams, while parts that were consciously perceived were excluded from the dream development. Pötzl called this differential utilization of percepts the "law of exclusion."

In the presentation of his results Pötzl utilizes a photographic procedure which involved the employment of underexposures, overexposures, and negative retouching of the stimulus pictures. It is his opinion that the individual steps of the photographic procedure are themselves fair analogues of the characteristics of the sensoriphysiological process involved in dream formation.

In Experiment I a colored slide of temple ruins at Thebes (Fig. 1) was exposed for $1/100$ second to the subject. On exposure he saw only something that he described as writing, "like hieroglyphics." Pötzl illustrates the parts of the picture that had been consciously noted in Figure 2, which was obtained by a negative retouching of the stimulus picture. Figure 3 shows what was not consciously seen, namely, the long wall and the shadow to the far right which resembles the silhouette of a tall, dark, human figure, with a crown of dark curly hair. This illustration was obtained by overexposure of the stimulus picture.

That night the subject dreamed that he had seen X in a certain garden. There was a wall with Y standing at the edge. The subject's drawing of his dream image is shown in Figure 4. It can be seen that it is a very good duplication of Figure 3, suggesting that the part of the stimulus picture not consciously seen during the exposure was unconsciously registered. In its formal pictorial properties, the drawing of the dream figure Y corresponds quite dramatically to the shadow figure in the stimulus picture. It can also be seen that if Figure 2, representing what was consciously seen, is superimposed on Figure 3, representing the parts of the picture not consciously noted, the entire original stimulus picture is reconstituted.

Pötzl notes that not all of the dream images in this experiment were derived from the exposed stimulus picture, but that natural day residues from recent events in the subject's life were drawn upon. Thus the X who appeared in the dream was connected with an experience in which the subject passed this person walking near a garden wall but did not notice him. This impression was nevertheless incorporated into the dream. Also, the garden wall in the dream represented a condensation of the memory image of the wall in the stimulus picture and the garden wall in the actual experience when X was passed by unnoticed.

Experiment II is presented as a confirmation of the findings of the first experiment. In addition, Pötzl attempts to demonstrate that the three separate dream images which appeared in *temporal succession* were derived from unconsciously noted percepts which were *simultaneously* registered. This is what is meant by the piecemeal delivery of the exposed stimulus picture into the dream after a delay. He stresses that simultaneity is transformed into succession.

A slide showing Jews praying at the Wailing Wall was exposed (Fig. 5). The picture shows the walls, the paved court, the square black silhouette of a door in the far background, and to the left a number of people leaning against the wall with arms upraised. On exposure the subject saw very little: "shadows, long stripes, like trees" (Fig. 6). In the subsequent dream the subject saw a large steamer on the sea; the water and waves shimmered white; the ship was black and only the front part, the prow and smokestacks, was visible. (The subject's drawing is shown in Figure 7b.) In the next dream image the ship became larger and was seen as entirely white (subject's drawing, Figure 8b), and finally, the dream images changed again and there were many people on the ship, waving their arms which appeared too large in relation to the bodies (Fig. 9).

Figures 7a, 8a, 9, 10, and 11 are photographic manipulations of the stimulus picture, attempts to show the elements in it which were incorporated into the successive dream images.

Pötzl now introduces two ideas which are of great importance in understanding his conception of the sensoriphysiological processes involved in dream formation. The first is the idea of the hidden, concealed, or embedded figure or picture, which is generally derived from background, as opposed to figural, elements in the stimulus picture. These elements are unconsciously apperceived and organized into a figure whose meaning differs from that which these elements have in the original stimulus picture. This is the same as the perceptual process by which one may see human or animal figures in cloud formations. For example, the side view of the white ship (Fig. 8b) in the second dream sequence was, according to Pötzl, derived from the background elements shown in Figure 8a. Such embedded pictures are extensively made use of in dream formation and are the kind of element that is readily excluded from conscious perception during tachistoscopic exposure of complex pictures.

The second important idea is that of the virtual or incipient eye movement. Pötzl advances the idea that at the moment of tachistoscopic exposure, which is much too brief to permit actual eye movements to take place, there are nevertheless innervations toward eye movements, virtual or incipient eye movements, although the eyes do not actually move. He believes that the interaction of these incipient eye movements with the spatial-geometrical relations and especially the perspective relations in the stimulus picture determine the organization of the succession of dream images and the direction of movement of the persons, objects, and events in the dream. Thus he assumes that, in this second experiment, at the moment of tachistoscopic exposure there was a virtual eye movement from the foreground to the background of the stimulus picture, ending at the vanishing point of the picture's perspective where the silhouette of the black door is located. This latter element was transformed into the black prow of the ship in the first dream image. There were then incipient eye movements from the vanishing point back toward the foreground of the picture with organization of the elements which went into the dream picture of the second ship seen in side view. Incipient eye movements then incorporated the row of people standing at the wall, transforming them into the third and final dream image of the people standing at the railing of the boat waving their arms.

The above description of the hypothetical virtual eye movements involved in Experiment II illustrates in a general way Pötzl's use of the eye movement concept but it omits the details contained in the paper. It is in such discussions that Pötzl is most obscure, confusing, and contradictory. The concept of a virtual eye movement taking place at the moment of tachistoscopic exposure is a dubious enough proposition, but Pötzl assumes far more than this, namely, a whole series of such virtual eye movements going from foreground to vanishing point, back again to foreground, movements that retrace their steps or change direction or move from right to left, all in ⅟₁₀₀ second. Pötzl seems to have been obsessed with the problem of these hypothetical virtual eye movements and it is his discussion of them that more than any other factor clutters up his presentation. It is frequently impossible to decide what he means when he describes the direction of the visual development of the dream in such phrases as "from the left periphery to the right, toward the center."

The presentation of Experiment III contains even more errors and contradictions than Experiment II. It is, however, of interest because of several rather convincing demonstrations of the correspondences between the drawings of the dream images and elements of the stimulus picture and because partial interpretation of the dream along psychoanalytic lines is attempted.

A picture of a railroad station, shown in Figure 12, was exposed to a female subject. The buildings on the right and left, the group of people on the platform in the foreground, the bridge in the background, and the locomotive at the end of the converging tracks on the right are to be especially noted. On exposure, the subject reported seeing many stores, many people in front of them, and a gap between the buildings on the right and left (Fig. 13). That night she dreamed that she went into a store in the street. There were three people. A little man wanted to stab her in the chest with a knife. She snatched the knife from his hand and threw it into a brook, near a bridge. A child came to the brook, took the knife out of it, but now it was much larger than before. The man was very excited. Then she escaped into a house and a lady took her in and took care of her.

The subject made a drawing of her dream image of the street down which she ran and of the little house at the end of the street, which is reproduced in Figure 15b. It can be seen that this drawing bears a striking resemblance to the converging railroad tracks with the locomotive at the end, as shown in Figure 15a, and Pötzl concludes that the dream image was derived from this element in the stimulus picture. Close inspection of the crowd of people standing on the platform reveals in the foreground a group composed of two women in white with a man to the left (Fig. 14). One arm of the man is extended horizontally toward the smaller woman in the middle, and between the two women can be seen a background shadow. The whole structure represents an embedded picture which gives the impression that the man is stabbing the woman in the chest. It is from this concealed figure that Pötzl concludes the dream image of the stabbing was derived. He points out that the subject was a nurse and this fact facilitated her identification with the woman in white in the stimulus picture.[1]

The nearby bridge and the brook into which the dreamer threw the knife were derived from the bridge in the extreme background of the stimulus picture and the platform which parallels the railroad tracks in converging perspective (Fig. 14). In Figure 15b a narrow, rectangular projection emerges from the left border of the street. This is said to be derived from the transformation and displacement of the man standing on the platform just to the right of the group of three from which the stabbing scene was derived.

One of Pötzl's astute observations is that the subject's description of her initial impression of the stimulus picture contains unconscious connections with the dream that followed and in a sense heralds the dream. For example, the subject's use of the word "gap" in describing the blurred impression of the space between the buildings represented a play on words, unconsciously relating to the fantasied stab wound, e.g., a symbolic reference to the female genital. Pötzl suggests that the content of the dream was already implicitly present or adumbrated at the time of exposure of the stimulus picture.

The direction of movement in the dream is said to be determined not only by the so-called virtual eye movements but by the reciprocal interaction of these eye movements with the geometrical, spatial, and perspective relations of the elements of the stimulus picture. For example, if the stimulus picture contained a river which flowed from left to right, this would generate an incipient eye movement in the same direction. It is assumed that at the time of exposure there was an incipient eye movement starting at the "gap" in the foreground of the picture, moving to the background to the area of the bridge and the "brook"; then, additional incipient eye movements down the railroad tracks to the locomotive at the vanishing point. In the dream, the dreamer herself moves down these tracks toward the little house, the tracks being transformed into a street, the locomotive into a house.

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[1] From Figure 14, it seems apparent which woman is the dream figure, namely, the one on the left with her back to the viewer. Also, the background shadow from which was derived the stabbing knife can be clearly seen. This is an excellent illustration of the use of an embedded picture involving a background shadow. However, in the text Pötzl makes a number of confusing statements raising doubt as to exactly which element in the stimulus picture is used in representing the dreamer in the stabbing scene. Additionally, it is not always clear exactly what Pötzl means by the "gap" although most of the evidence points to the white spot shown in Figure 13. His discussion of the virtual eye movements involved in this dream is also highly contradictory and Pötzl frequently appears to juggle his data, describes things vaguely and inaccurately, and intersperses long discussions of all kinds of peripheral matters.

Pötzl's interpretation of the dream along psychoanalytic lines is as follows: The stabbing scene represents a symbolic sexual attack; the knife, the phallus of the attacker. The converging lines of the subject's drawing of her dream image of the street and the house symbolically represent contours of the thighs spread apart as they frequently appear in primitive obscene drawings such as one finds in public lavatories. The black locomotive, transformed into the house at the end of the street, is a symbolic representation of the female genital. Pötzl suggests a series of relationships as follows: the gap—man—phallus—knife—brook (interfemus), all of them involved in the symbolic representation of the attack.

The meaning of embedded figures provides a link between sensory physiology and psychoanalysis. As has been noted, Pötzl believes that the dream work and the transformation of the latent dream thoughts into visual images utilize embedded figures and may begin at the moment of tachistoscopic exposure.

In his most important formulation, Pötzl states that there are three totally different factors: *a sensory, a motor, and a symbolic,* which *determine* the sequence of the dream development. None of these three factors alone determines this sequence, but each imposes its "period" on the other two so that the result may be compared to coupled oscillations. The sensory factor refers to the unconscious registration of percepts and the fragmentation of the stimulus picture so that what is registered simultaneously emerges into consciousness as successive dream images. It refers also to the speed and character of these so-called "delayed visual developments," the ease or difficulty that the different elements of the stimulus picture have in reaching full development, i.e., emerging into consciousness, and the shorter or longer duration they require to do this. The motor factor has to do with the role of virtual eye movements in determining the sequence of development of the dream images and the movement of objects, persons, including the dreamer, and events in the dream. Finally, the third factor, symbolism, appears as an independent determinant of the succession of dream images. According to Pötzl, he demonstrated experimentally that the sexual symbolism of the dream work is represented in the illustrations. The sexual symbolism seems to have influenced the course of events in the dream and to some extent selects the dream material, by slipping into the "empty shells" (embedded figures) potentially available in the stimulus picture. It spontaneously extracts, creates, and resolves an embedded picture from the unconsciously registered stimulus picture. Symbolism functions as a principle of apperception, the speed of which in these experiments is $\frac{1}{100}$ second.

In the discussion of this experiment, Pötzl introduces a new concept which he calls "inhibition by interference." For example, in the crowd of people in the left foreground there is a second group of three men to the left of the group of three already described (Fig. 14), which may have entered into the dream image of the stabbing.[2] Pötzl believes that both groups were involved and that they mutually interfered and fused with one another and thus acted as a brake in the impetus to further development without completely effacing one another. It is at the point of such an inhibition by interference that the unconscious development of the dream sets in and the embedded picture is selected out of the stimulus picture. This constitutes a "branch point," a sort of nucleus for further developments. It is relatively independent of psychoanalytic factors.

At the point of "inhibition by interference," at the instant of tachistoscopic exposure, a fragmentation of the stimulus picture begins. The fragments are pulled in various directions, one group emerging into consciousness immediately or later on during the day, and a second group separated off as though by a repelling force, remaining unconscious, and drawn into contact with repressed material. In the so-called branch point, both these phases coexist as dispositions.

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[2] The identification of the second group of three is a matter of extreme difficulty. There is no group which can be described as in the "left foreground." In the far left middle ground is a group of men, but there appear to be at least four. The whole matter is extremely obscure and it is not clear whether Pötzl is discussing five people or six.

Pötzl is of the opinion that the embedded picture containing the knife need not have originated at the instant of exposure, as he earlier alleged, but may have emerged later during the dream work at night. At the time of exposure the different form elements in the stimulus picture are present in various degrees of facilitation and inhibition. The embedded picture remains as a residue capable of exerting effects; in the dream work it becomes charged with repressed material which serves to activate it and to make it appear in its original form. In turn, however, this repressed material impresses its own meaning upon the embedded picture, out of which all the rest of the dream events seem to follow. The repressed material, while it has no form and does not contribute to the visual-motor reaction, functions as a catalyst.

The following is an excellent illustration of the manner in which Pötzl attempts to draw analogies and parallels between the sensoriphysiological processes of the dream and its psychological meaning. For example, he refers to the stabbing scene as an inhibited sexual act, since the dreamer was not actually stabbed but snatched the knife from her attacker's hand. This inhibition corresponds to the point where the visual-motor direction was inhibited, i.e., the point of "inhibition by interference" described above. The visual-motor development was resolved when the dreamer fled into the house, symbolically representing the female genital, and was received and taken care of by a lady. The dream, according to Pötzl, ended in relative satisfaction and abreaction. The events of the dream follow the rhythm of the visual-motor development, as though keeping step with it, as do the latent impulses of the repressed. The tachistoscopic stimulation sets up an "inhibited innervation" and there is a tendency to reintegrate what has been inhibited, that is, to recover and permit emergence into consciousness of the parts of the picture that remained unconscious. The completion of this emergence or reintegration coincides with the wish fulfillment of the dream, in this case, a return to childhood or, beyond childhood, back into the womb, e.g., the house derived from the locomotive.

In the presentation of Experiment IV, Pötzl states that the three determining factors worked in especially good harmony and that therefore the so-called "delayed visual developments" were optimal. Actually, however, correspondences between the drawings of the dream images and elements of the stimulus picture are not especially convincing and the experiment will not be summarized in detail. It is of interest chiefly because of the introduction of a perimetric setup, which determined that the tachistoscopic stimulus would affect only the peripheral vision. The exposure took place to the right so that the outer 50 to 60 degrees of peripheral vision were stimulated, sparing the inner 20 degrees of binocular vision.

In this experiment, Pötzl is able to confirm the idea that in normal indirect vision the same fragmentation of the stimulus picture with delayed delivery into consciousness takes place that he found in the case of Obszut. As can be seen from the title of his paper, Pötzl is specifically interested in the relationship of the experimentally produced dreams to indirect vision. From the findings of Experiment IV and the observations on cases with preserved indirect vision and destroyed central vision, it is clear that the perceptual phenomena that have been described are related to indirect vision. It is not apparent, however, just what role was played by central vision, which was involved in all but one of the tachistoscopic dream experiments. Pötzl makes various rather confusing statements about the matter. He points out that indirect vision can assume the properties of direct vision and vice versa. He states that in every visual act direct and indirect vision may be transformed into one another. In the patient Obszut, he observed that indirect vision finally took on the properties of central vision and that a pseudofovea was established, i.e., a new foveal area that took over the functions of the fovea that had been eliminated by the destruction of central vision.

Pötzl is aware of and discusses the complex factors involved in the selection of elements of the stimulus picture that are subsequently involved in dream formation. All three organizing factors, the sensory, the motor, and the symbolic, exert a selecting influence. In tachistoscopic exposure, certain elements of the stimulus picture, such as ground as opposed to figural elements, by virtue of their weak stimulus intensity remain subliminal and are especially suitable for incorporation into the dream. He notes that in the case of

Obszut the visual developments under consideration came about without brief tachistoscopic exposure. With this patient, parts of the stimulus picture which he failed to perceive or recognize, that is, was agnosic for, would have been perceived and recognized by normal subjects under the same stimulus conditions. In the dream experiments with normal subjects, the condition of inability to perceive or recognize certain parts of the stimulus picture was brought about artificially by means of tachistoscopic exposure. Pötzl points out that the same visual developments can also occur in normal indirect vision without brief exposure, under conditions where the reduction or deflection of attention causes exclusion from consciousness of certain elements of the stimulus picture. That is, elements which are supraliminal behave in the same manner as those that are subliminal[3] if attention is deflected from them. Thus, similar effects can be obtained in four conditions: (a) in agnosic patients without brief exposure; (b) in normal subjects following tachistoscopic exposure where both central and indirect vision are involved; (c) in normal indirect vision without brief exposure; and (d) in conditions where the level of attention is lowered without brief exposure.

Another selective factor is mentioned, namely the role of past experience and the influence of the correspondence between past memory traces and elements of the stimulus picture. The symbolic factor also is said to play a role in the selection of elements from the stimulus picture, as noted above. Pötzl equates the symbolic factor with the "repressed" and discusses it largely in relation to embedded pictures. For example, the subject in Experiment III, who was presumably struggling with repressed wishes relating to sexual attack, selected out of the stimulus picture an embedded picture which was transformed in the subsequent dream into the knife. Finally, the motor factor, which functions chiefly to organize the movement of the dream and the succession of dream images, also is said to have a selective influence when, for example, it sets up a so-called "inhibition by interference."

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[3] In this summary we have from time to time used the modern term "subliminal" which was never employed by Pötzl. We have frequently used "subliminal" to refer to what Pötzl thought of as "unnoticed" or "preconsciously perceived." The term "preconscious perception" is not a good one, as both Klein (1959b) and Fisher (1959) have pointed out. We do not know whether Pötzl was actually dealing with completely subliminal stimuli. It seems most appropriate to employ the term "incidental" stimulation, proposed by Klein, under which a number of varieties can be subsumed, e.g., stimuli from which attention is deflected, those that appear in indirect vision, and, at the extreme end of the scale, the totally subliminal.

Pötzl expresses some reservations about the so-called "law of exclusion." He points out that it can be demonstrated experimentally only in conditions where the subliminal elements can be separated from the consciously perceived ones and where the subliminal stimulus can be controlled. Under normal conditions, the strict validity of the law of exclusion does not hold because other factors enter in. Consciously perceived elements do enter dreams but only if attention is deflected from them. With every drop in the curve of attention, persisting impressions find more ready access into dreams. The preconscious memory traces of consciously perceived elements from which attention is deflected attain the qualities which preconsciously (subliminally) perceived elements have at the start. This is the same formulation that Freud made for the role of indefinite impressions as day residues for dream formation, i.e., elements which did not receive attention cathexis or from which cathexis was quickly withdrawn.

Pötzl believes that the technical, photographic tricks used in presenting the material are equivalent to the sensoriphysiological processes involved in dream formation: (1) The use of cover-color (blotting out certain parts of the stimulus picture) shows the law of exclusion. (2) The pictures of the dream images, when superimposed upon one another, yield an approximation of the originally exposed stimulus picture and this shows that a succession of visual aftereffects, separated by irregular temporal intervals, developed in the form of isolated part-impressions. (3) The use of enlargements and reductions portrays the dream as it subjectively appeared to the dreamer. The enlarging and reducing are part of the dream process itself and are brought about by the blocking of eye-movement innervations.

Pötzl makes an interesting clinical observation that paranoiacs permit the intrusion into consciousness of peripheral impressions: indistinct conversations, grimaces, facial expressions, gestures, etc. Although their reality-oriented perception is increasingly impaired, they take in elements in indirect vision and hearing that in normal people remain outside of awareness and are suppressed by the process of abstracting.

In concluding, Pötzl states that he is not concerned with an experimental demonstration of the validity of Freud's dream theory. He is primarily interested in brain pathology and the sensoriphysiological aspects of these experiments. He believes, however, that his findings provide the desired bridge from psychoanalysis to sensory physiology and the physiology of the nervous system. They extend the psychic mechanisms of the dream to the sensory material involved and to the "general mechanisms of the simpler innervations," including inhibited innervations. Pötzl believes that the selection of impressions registered in indirect vision is influenced by such "inhibited innervations," as well as by the analytic factors discovered by Freud. The experimental procedure itself introduces inhibited innervations of this sort, which, according to Pötzl, are conducive to subsequent dream formation. For example, tachistoscopic exposure introduces an inhibited intention (innervation) because the exposed picture is only partly perceived and there is thus set up a tendency toward reintegrating the entire stimulus picture, that is, bringing the unconsciously perceived elements into consciousness. This factor may be reinforced by the curiosity it arouses in the subject. Pötzl, therefore, speaks of a "general reintegration tendency of inhibited acts" and equates this with Freud's principle of wish fulfillment. By this he means that the tendency of the unconscious repressed to push its way into consciousness is a similar attempt at reintegration of an inhibited act.

Pötzl's chief findings, formulations, and conclusions may be summarized as follows:

1. Percepts of indirect vision, errors of normal people in tachistoscopic vision, visual dream images of normal persons, and visual errors of patients with agnosia have many essential characteristics of form and content in common. The agnosic patient reacts to visual stimuli in the same way as the normal person reacts to tachistoscopic stimuli, to stimuli perceived when attention is lowered, or to preconscious impressions derived from indirect vision. It is one of Pötzl's great merits that he saw the interrelationships of the findings in all these conditions and synthesized them with observations of earlier investigators such as Helmholtz, Purkinje, Johannes Müller, and especially with the observations of Urbantschitsch on eidetic imagery.

2. When a stimulus picture is tachistoscopically presented, as in

the experiments reported, parts of the picture will be registered outside of the subject's consciousness.

3. These subliminal elements will appear in consciousness after a delay of minutes or hours.
4. The state of consciousness in which the subliminal elements emerge is generally an altered or pathological one, such as dreams or hallucinations.
5. The memory images of the unconsciously registered elements may be more or less photographic duplications of part of the originally exposed stimulus picture, but more often are transformed and distorted in various ways.
6. The transformations and distortions that the images undergo resemble those which Freud described as taking place during the dream work, i.e., condensations, displacements, symbolic transformations, etc.
7. The perceptual developments described are attributed to the release from inhibition of processes normally present but held in check by an "abstracting process." This abstracting process can be eliminated by brain damage and is normally in abeyance in the regression involved in sleep and dreaming.
8. Only the subliminally registered elements appear in subsequent dreams, while the consciously perceived ones are excluded. This is called the "law of exclusion." It does not necessarily hold under normal everyday conditions where consciously perceived elements from which attention is deflected or impressions registered in indirect vision may play the same role as subliminal elements.
9. There are three important determining factors in dream formation, namely, a sensory, a motor, and a symbolic, all of which interact with one another to produce the dream.
10. There is a "general reintegration tendency of inhibited acts" which Pötzl equates with Freud's principle of wish fulfillment. The unnoticed parts of the stimulus picture and the unconscious repressed are both considered to be "inhibited innervations" which show a tendency toward reintegration, that is, a tendency to push their way into consciousness.

SUMMARY OF PAPER BY ALLERS AND TELER

This monograph contains the first English translation of a much shorter paper by Allers and Teler published in 1924. In the more than thirty-five years of its existence, it has been even more neglected than Pötzl's work. In the original it is lucidly written and is here excellently translated, and no extensive summary will be undertaken. It was the first investigation to be influenced by Pötzl's method, although it deals with imagery and not dreams. Influenced by William James's concept of "fringe" states of consciousness and Schilder's similar concept of the "sphere," Allers and Teler undertook to investigate mental phenomena of a nonverbal character, namely, fleeting impressions and their effect upon imagery. They were interested in demonstrating whether impressions that are "not noticed" can intrude into conscious processes. The day following tachistoscopic exposure of pictures to subjects, an attempt was made to investigate whether unnoticed elements of the stimulus picture would emerge into the subject's images. This was done by carrying out a word association test made up of a list of stimulus words which described the unnoticed elements of the stimulus picture. The subjects were required to make drawings of any images that occurred to them between the stimulus and reaction words. The results indicate that there was extensive recovery of unnoticed elements of the stimulus pictures in all the subjects' images.

Allers and Teler discuss the problem of what laws control the emergence of the "unnoticed" and the problem of the form in which unnoticed elements exist so as to be able to emerge. They suggest that two factors are at work: (a) expositional and (b) dispositional factors. By expositional factors they refer to the obtrusiveness of certain elements in the stimulus picture. By dispositional factors they refer to the "set" of the subject to give a verbal report of what he sees. Such a set lends significance to the elements that are "namable," i.e., "word near." The unnoticed elements are "word distant" and emerge as "representations," i.e., images. The authors do not believe that "unconscious determining tendencies" and the symbolic factor mentioned by Pötzl played a role in these experiments. They are opposed to the idea that the unnoticed elements are unconscious, and assume rather that the "unnoticed" is in fact "noticed" but belongs to the realm which Schilder calls the "sphere." They believe that in these experiments the word-near elements came forward under the influence of the experimental instructions while the word-distant elements remained in the sphere but nonetheless in consciousness. The latter were not "important" for the task at hand and therefore were neglected. They do not believe that unconscious factors and repression played any part in the selection of what was perceived or not perceived.

REVIEW OF THE LITERATURE

Replication and Validation of the Pötzl and the Allers and Teler Experiments

In the early 30's, Malamud and Linder (1931) reported some dream experiments based upon Pötzl's method. They were primarily interested in validating Freud's formulations about day residues, and attempted to demonstrate that recent experiences, forgotten or repressed, recur in dreams, and that such recent experiences are related to earlier, repressed incidents. They did not utilize the tachistoscope, but exposed pictures for 30 seconds to their subjects, state hospital patients receiving psychotherapy, mostly psychoneurotics, patients with affect disorders, and schizophrenics. For each subject they chose a picture whose content they believed had some relationship to the patient's specific conflicts. For example, a picture of the Madonna and Child was shown to a patient with conflicts of an oral nature involving the mother-child relationship. They were able to demonstrate that conflict-charged elements were omitted from the initial description of the pictures and incorporated into subsequent dreams. These experiments were important because they demonstrated that tachistoscopic exposure was not necessary, that even with prolonged exposures elements of the stimulus pictures could go unnoticed owing either to the withholding or rapid withdrawal of attention from an emotionally charged element, as both Freud and Pötzl had suggested.

Several years later, Malamud (1934) reported some additional experiments utilizing verbal material instead of pictures. A passage containing sexual symbolism was read to patients who attempted to reproduce what they had heard immediately afterward. It was found that details of the original passage, omitted or distorted in attempts at reproduction, were incorporated into subsequent dreams.

Although the Allers and Teler and Malamud investigations were influenced by Pötzl's method, there were no attempts to replicate the actual Pötzl experiment for about thirty-five years. The Allers and Teler experiment was also ignored, and a twenty-year silence followed the publication of Malamud's extremely interesting findings. In the last six or seven years, however, there has been a sudden revival of interest on the part of both psychoanalysts and experimental psychologists in the Pötzl dream experiment. On the part of psychoanalysts this renewed interest has grown out of developments in ego psychology, more specifically out of a greater concern with both the conflictual and nonconflictual adaptive aspects of the functioning of the ego apparatuses of perception, memory, and cognition. At the same time, the so-called "New Look" experimental psychologists, interested in the impact of personality and of affective and drive-related factors on perceptual processes, have begun to investigate the role of incidental or fleeting impressions occurring outside of or on the fringe of awareness. Workers in laboratories throughout the United States and abroad have been involved in such studies. The principal investigators are Klein, Holt, and their co-workers at New York University, Luborsky and Shevrin at the Menninger Foundation, Fisher and his co-workers at Mount Sinai Hospital, Hilgard at Stanford, Dixon in London, and Smith and his co-workers both here and in Sweden.

In 1954 I undertook the first systematic replication of the Pötzl experiment, attempting to integrate the findings into the psychoanalytic theory of the dream process. In general, Pötzl's findings in relation to two of the three major determining tendencies, namely, the sensory and the symbolic, were confirmed. It was shown that unnoticed elements of tachistoscopically exposed pictures were extensively utilized in subsequent dream formation, that is, the so-called sensory factor mentioned by Pötzl influenced dream formation in the manner described by him. It was further demonstrated that the unnoticed elements were influenced by unconscious wishes and subjected to primary-process transformation. It was shown that the unnoticed elements not only underwent symbolic transformation but that all the primary-process mechanisms of thought, such as condensations and displacements, were brought into play.

The most speculative of Pötzl's formulations concerned what he called the motor factor, that is, the role of incipient eye movements. He believed that incipient eye movements, innervations toward eye movements, were aroused during tachistoscopic exposure of stimulus pictures. These virtual eye movements were then transformed into perceptions of movement in the dream at night, organizing the movement of dream images and determining their succession. No subsequent investigator has paid any attention to the motor factor which so preoccupied Pötzl. His concept of the virtual eye movements is difficult to accept. He not only assumed that at the moment of tachistoscopic exposure there was some sort of all-encompassing, virtual eye movement, which he called the "overview," that took in the entire stimulus picture, but, in addition, that there was a complex series of such virtual eye movements oscillating from foreground to background, reversing direction, moving from right to left, etc., all occurring in 1/100 second. Pötzl did not actually demonstrate in any way that such virtual eye movements occur but inferred them by a process of circular reasoning. Although he assumed that the virtual eye movements interacting with the geometrical, spatial, and perspective relations of the stimulus picture determine the movement of the dream images and their succession, in actuality he inferred the direction of the alleged incipient eye movements from the movement of the dream images and their succession.

It is somewhat ironic, however, and a tribute to Pötzl's prescience, that the recent work of Dement and Kleitman (1957) has demonstrated that eye movements do play an extremely important role in dreaming although not in the manner conceived of by Pötzl. It has been shown that dreaming is accompanied by rapid vertical and horizontal eye movements as the dreamer views the hallucinatory dream images, and that the eye movements are coordinated with the direction of movement of objects and events in the dream. Further investigation will be needed to determine whether there is any substance in Pötzl's concept of the virtual eye movement. It may be possible by using present-day electronic techniques to determine whether incipient eye movements take place during tachistoscopic exposure and whether these are in any way reflected in the eye-movement patterns that take place during dreaming.

The next replication of the Pötzl experiment was carried out by Luborsky and Shevrin (1956). They confirmed the basic phenomenon, and asserted that it was a special case of a larger process characterized by many more evidences of defensive activities than omission of parts of the picture. They suggested that omission is related to repression but that other defense mechanisms, such as denial, negation, and isolation, were involved in the subjects' responses to the tachistoscopic exposure. They also reported that recovery of percepts occurred in ego states other than the dream state: for example, they found some of the best and most complete recoveries of subliminal registrations when the subject was asked to image. In effect, they were one of the first to confirm the Allers and Teler type of imagery experiment. Characteristics of the initial tachistoscopic perception and the subsequent recovery of unnoticed elements were found to be related to the subject's perceptual style. In a later study, Shevrin and Luborsky (1958) were the first to apply objective methods in validating the Pötzl phenomenon, and to develop a quantitative measurement of "preconscious perception in dreams and images." Their findings support the so-called "law of exclusion" formulated by Pötzl, but only if the law is somewhat modified: elements of the exposed pictures that were consciously perceived did appear in subsequent dreams and images. They concluded that Pötzl's law is only relative and was intended mainly to emphasize that the dream was a better vehicle for the unintentional emergence of subliminal registrations into consciousness than is intentional recall in the waking state. On the other hand, dreams and images are relatively inefficient means, as compared with intentional recall in the waking state, for recovering consciously perceived elements of the tachistoscopically exposed picture.

In 1960 I also found that consciously perceived elements are incorporated into subsequent dreams. By simultaneously exposing a supraliminal and a subliminal stimulus it was possible to investigate the different utilization in the dream of subliminally registered elements as compared to consciously perceived ones. It was shown that the subliminal stimulus is drawn into the drive organization of memories, subjected to primary-process transformations, and appears in the manifest content of the dream in image form. These manifest images are related to the repressed, drive-oriented, wish-fulfilling aspect of the dream. The supraliminal stimulus, on the other hand, appears to activate preconscious trains of secondary-process thought, direct derivatives of the stimulus emerging in the dream in verbal, conceptual form.

I was also able to confirm the essential findings of the Allers and Teler imagery experiment (see Fisher, 1956). I found that elements of the tachistoscopically exposed pictures appeared in subsequent imagery, not only 24 hours after exposure, but within minutes. Unlike Allers and Teler, I reported that the memory images of subliminal registrations underwent the same kinds of primary-process transformations and distortions as had been reported in the Pötzl dream experiment. In a subsequent investigation (1957), I used a modification of the Allers and Teler method. It was found that the word association part of the experimental procedure was not necessary, and that if the subject was asked to produce images immediately after tachistoscopic exposure, elements of the stimulus pictures would appear in the imagery. In experiments combining the Pötzl dream technique with the imagery method, it was shown that the images that developed during the imagery experiment may appear in an identical or related form in subsequent dreams and provide some of the raw material of the manifest content of the dream. These findings were discussed in relation to Freud's theory of dream formation, and certain modifications of Freud's theory were suggested. Specifically, it was indicated that the dream process may begin during the day at the instant of tachistoscopic exposure, as Pötzl suggested. In discussing the implications of the findings for perceptual theory, I proposed that perception is a temporally extended process which can be broken down into three phases: (1) the registration of the percept outside of consciousness; (2) contact of the percept with a pre-existing memory schema, also outside of consciousness; and (3) emergence of the percept into consciousness. This formulation, related to Schilder's (1924) theory of perception, suggests that the perceptual process involves a number of phases, the preliminary stages taking place outside of awareness. It should be remarked that during the long period of neglect of Pötzl's findings, Schilder was one of the few of the older workers who drew upon them in constructing his theories of perception and memory.

In individual and group experiments (Fisher and Paul, 1959; and Paul and Fisher, 1959) we attempted to validate the Pötzl dream experiment and the Allers and Teler imagery experiment by correcting the methodological deficiencies of previous research. We instituted as many experimental controls and checks as possible, utilizing objective methods and statistical evaluation. We were able to validate the Pötzl phenomenon and the effect of subliminal stimulation on subsequent images and to demonstrate that these effects could be manipulated in predictable ways. We concluded that subliminal visual registration is a genuine phenomenon and that it may influence dreams and images. We reported evidence that during subliminal registration the figure-ground effect becomes fluid or is eliminated. We also found that the supine position in darkness enhances subliminal sensitivity, as compared to the upright position in a lighted room. The results suggested that the Gestalt laws of good continuation, closure, figure-ground, etc., may hold for the particular state of consciousness mobilized in the usual laboratory perceptual task, but that they may not apply to subliminally registered forms.

From a methodological point of view, perhaps the most thoroughgoing attempt to validate the Allers and Teler experiment was undertaken by Fiss, Goldberg, and Klein (1960). They first determined each subject's threshold for partial recognition of the stimuli and then exposed the stimuli at 1.5 m.sec. below this threshold. They used objective methods of evaluating the images and concluded that though a low-level stimulus may not be discriminable in the usual alert state of consciousness, it may nonetheless exert effects demonstrable in other modes of conscious experience, such as imagery.

Dixon (1958) reported positive results in his investigation of the effect upon verbal and autonomic behavior of subliminal verbal stimuli, utilizing the GSR as an indicator of autonomic change. In an earlier study Dixon (1956) found that verbal responses subjectively experienced as random guesses were determined both in latency and content by verbal material previously presented subliminally either in the visual or auditory sphere. These findings pointed to some discrimination of meaning at an unconscious level. The fact that subjects were subsequently able to identify those stimulus words which had preceded certain responses was interpreted as additional proof of such discrimination. Dixon used a number of sexual words as stimuli and found that some of the responses were Freudian symbols.

Finally, Hilgard (1958) has reported a replication and confirmation of the Allers and Teler imagery experiment.

Subliminal Influences upon Conscious Thought

Klein, Holt, and their co-workers have followed a lead suggested by Pötzl's results: namely, that incidental, peripheral, or subliminal registrations may actually promote participation of percepts in ongoing conscious thought. The Allers and Teler experiment had already shown that subliminal stimuli may influence the kind of conscious thought process represented by imagery. Klein, Holt, and their co-workers reported a series of experiments using the so-called "masking" technique, by which the influence of subliminally presented figures is determined by the study of associated changes in the subject's responses to a consciously seen figure. The masking technique, introduced by Smith and Klein, was first used by Smith and Henriksson (1955), who exposed tachistoscopically, in rapid succession, a line design and a square which together constitute a well-known optical illusion. They found that the optical illusion could be elicited when the exposure time of the square was kept constant and was consciously perceived, and the line design remained subliminal. In another study, Smith and Henriksson (1956), using pictures, confirmed the finding that subliminal stimuli may exert a significant influence on conscious perception. Klein, Spence, Holt, and Gourrevitch (1958) demonstrated that subliminally presented sexual pictures and symbols affected the conscious impressions of the masculinity or femininity of faces. Smith, Spence, and Klein (1959) presented the words "Happy" or "Angry" subliminally prior to a male face which was presented supraliminally. They found that the subject's evaluation of the face was dependent upon the subliminal word, the face becoming more pleasant and positive when preceded by "Happy" and unpleasant and negative when preceded by "Angry." Bach and Klein (1957) repeated the Happy-Angry study, using prolonged subliminal exposures, and confirmed the results of the earlier study. Eagle (1959a), using the masking technique, demonstrated that a subliminal picture with aggressive content influenced the perception of a subsequent consciously perceived neutral figure so that it was seen as more aggressive and negative. Kolers (1957) investigated the influence of subliminal stimuli in problem solving and was able to show that subliminal cues influenced the kind and number of solutions given.

The Problem of Individual Differences

All investigators in this field have observed that there are rather wide individual differences in the degree to which subliminal stimuli influence dreams, images, or conscious thought. Early in my work (1954, 1956) I reported that subjects who were capable of free fantasy, who were not emotionally constricted, who were relatively free of anxiety or hostility during the experiment, and who had a good positive transference to the experimenter, appeared to show greater subliminal effects. I also noted that constricted, obsessive-compulsive subjects or anxious, hostile subjects tended to show no or very little utilization of subliminal registrations in dreams or images. I did not, however, attempt a systematic exploration of these differences. Klein, Holt, and their co-workers have published a number of investigations bearing on the problem of individual differences. Smith and Henriksson (1955) found reduced subliminal sensitivity in subjects who tended to use isolation mechanisms. In a later study (1956), the same authors found that compulsive, paranoid, and hysteric patients handled subliminal stimuli in different ways. Bach and Klein (1957) reported that subjects sensitive to subliminal stimulation showed greater psychological-mindedness, greater empathy, better ability to deal with unstructured situations, and were more passive-receptive. Subjects low in sensitivity tended to give glib, highly structured responses, and only passing, stereotyped references to inner thoughts and feelings. Klein, Spence, Holt, and Gourrevitch (1958) found that subjects who manifested rigid graphic concepts in their drawings were the least subliminally sensitive, while the most sensitive subjects showed an unstructured, uncrystallized set of graphic concepts of human bodies. Smith, Spence, and Klein (1959) found that highly sensitive subjects showed greater flexibility, while the less sensitive subjects adhered rigidly to detail. Also, the most sensitive subjects were more tolerant of passive attitudes and more optimistic about the consequences of submission.

In an interesting study, Lapkin (1960) investigated the hypothesis that a person who is able to forego executive intentions and whose fringe motives are available to consciousness will show a greater effect of the subliminal stimulus than a person whose thinking is rigidly oriented toward reality. An additional postulate was that among those responsive to the subliminal stimulus, by virtue of the greater availability of primary-process mentation, there will be a difference between those whose regression is adaptive and those whose regression is pathological. Lapkin utilized psychiatric and medical patients as subjects, dividing them into groups according to whether they showed a high or low percentage of primary-process responses on the Rorschach and good or poor controls (defenses). He found increased sensitivity to subliminal stimulation only in the group of psychiatric patients with high primary process and poor control, although he had predicted that the group with high primary process and good control would show the greatest sensitivity. There is good reason to believe that this latter group actually does give the best subliminal effects. For example, many of the striking results of subliminal stimulation reported in my early papers (1954, 1956) were obtained with subjects of this kind, selected on the basis of clinical impressions. Many of them were artists, creative individuals, or persons who had been analyzed, all of whom showed an excellent capacity for "regression in the service of the ego" in the presence of relatively good and stable defenses. Lapkin's failure to obtain good results from his group with high primary process and good control probably resulted from the fact that the experiment was carried out under conditions which produced anxiety in the subjects, as he himself pointed out.

The most extensive attempt to isolate the personality correlates of "subliminal sensitivity" has been made by Eagle (1959b), who reported that those who are subliminally sensitive show an interpersonal orientation, cognitive and affective openness, receptivity to inner cues, a concern with aggressive impulses, a tendency to act out impulses rather than to use obsessive defenses, etc. Many of the differences between the high and low sensitive subjects could be covered by the statement that the high sensitive subjects showed a greater capacity for adopting a "noncritical regressive attitude." Such subjects were able to drop temporarily the normally adaptive, reality-oriented attitude, give up active secondary-process controls, and accept or passively receive the ideas, fantasies, intuitions, and nuances that emerged. That is, they were able to tolerate primary-process thinking. Another important finding was that the subliminally sensitive subjects showed a more flexible and even type of attention cathexis. As a result of this, sensitive subjects keep stimuli less fixed, less rigidly structured, and more subject to influence and change by other stimuli or motivational states. The two chief findings, therefore, were that sensitive subjects show a "regressive attitude" and more flexible attention cathexis. Therefore, if we know that a subject shows a more flexible type of attention cathexis and has less need for vigilant control and heightened accuracy, we can predict that he will be more likely to show a noncritical regressive attitude. The author was able to place many of the findings of his study in the context of either adaptive regression or type of attention cathexis. In connection with Eagle's comments about type of attention cathexis, the investigation of Shevrin and Luborsky (1959a) on the disappearance of fleeting impressions as a function of repression is of interest. They showed that not everyone experiences the Pötzl phenomenon in the same way. They reported that those subjects who lost information after their initial report of the tachistoscopic exposure, whom they called "decreasers" or "repressors," as opposed to "increasers," had a greater recovery of subliminal registrations in subsequent dreams and images. They also made the suggestion that a rapid fluctuation of attention might be typical of repressors.

In another study of individual differences, Fox (1960) confirmed the work of others, reporting that subjects sensitive to subliminal stimulation were "disinhibited" during the period when they were responsive. Disinhibition is defined as a relatively imaginative and uncritical frame of mind. Spence and Paul (1959) investigated the degree of subliminal sensitivity in subjects with different styles of remembering, referred to as importers or nonimporters. The importer is one who regularly elaborates his memory reproductions, adding new material to enhance continuity and sense. It was found that importers showed the subliminal effect, i.e., they fused properties of a subliminal stimulus with properties of a supraliminal stimulus. The authors concluded that importing is related to a major aspect of subliminal sensitivity: the ability to fuse disparate impressions or to incorporate elements of one sensory experience into impressions of a second. The relationship of importing to other measures of subliminal sensitivity, such as the capacity for adaptive regression, has not been worked out.

Subliminal Stimulation and Primary Process

In my early papers (1954, 1956, 1957), I suggested a distinction between primary-process and secondary-process perception. I suggested that early in development the perceptual process is under the control of the drives and primary process, and has a special susceptibility to subliminal stimulation. With the growth of the ego and maturation of the perceptual apparatus, this early primitive stage of perception becomes inhibited and overlaid by the more mature, reality-oriented perceptual processes. The New York University group has carried out extensive investigations on the relationship between subliminal stimulation and primary-process thought. Pine (1960a) investigated the effects of incidental stimulation on subsequently produced stories, comparing the quality of effects produced by incidental as opposed to focal stimulation. He found that irrelevant incidental stimuli tend to emerge in the stories in transformed, primary-process ways, while relevant focal stimuli appear in a more direct secondary-process context. In this study an incidental symbolic drive stimulus was employed. In a later investigation, Pine (1960b) studied the effect on subsequent stories of an incidental stimulus in which the drive content was explicit. He found that in these circumstances the incidentally presented drive stimulus affected the stories by inhibiting both secondary- and primary-process content derived from the stimulus. Bach (1959) reported findings similar to those of Pine's first study. He found that the words "room" and "water," presented subliminally or incidentally, led to mother-related word associations, an effect quite distant from the original stimulus words but in accord with their conceptual value as mother symbols. Pine (1960c) reported that when he presented the word "cow" subliminally to a group of subjects, an increase in mother-related, oral passive content in subsequent images occurred, but not an increase in images related to cows, farm animals, food animals, or the like. Pine's results suggest that at least for certain types of responses, such as storytelling, symbolic subliminal stimuli have a greater effect than stimuli in which the drive content is more explicit.

In my study of the effect of the simultaneous exposure of subliminal and supraliminal stimuli on subsequent dream formation (1960), I presented preliminary evidence that the two types of stimuli are used in different ways. The subliminal stimulus appeared to resonate with the drive organization of memories, to undergo primary-process transformation, and to appear in the manifest content of the dream as an image related to the wish-fulfilling aspect of the dream. The supraliminal stimulus appeared in the dream transformed in a conceptual secondary-process manner, frequently in verbal form and closely related to the ego aspects of the dream. Shevrin and Luborsky (1959b) noted that in previous studies of the Pötzl phenomenon, investigators have suggested a kinship between the distortions undergone by initially undescribed elements appearing in waking images, dreams, and the effects of such primary-process mechanisms as displacement and condensation. In an extremely interesting and ingenious investigation, these authors attempted to create an experimental situation in which displacements and condensations, made possible by a state of reduced awareness brought about by tachistoscopic exposure, could be predicted and observed. To investigate and compare primary- and secondary-process mechanisms, they utilized a rebus composed of pictures of a tie and a knee which when condensed form the word "tiny." They were able to show that these stimuli, unidentified owing to tachistoscopic exposure, were subject to primary-process displacements and condensations. The pictures of the tie and the knee underwent primary-process transformation and were unconsciously apperceived as the word "tiny." On the other hand, these same pictures, when completely consciously recognized and identified, were not subject to displacements and condensations and the rebus effect did not take place. It was suggested that tachistoscopic exposure is a form of stimulus deprivation sufficiently strong to force otherwise normal egos to perform operations typical of dream and psychosis.

The Controversy over Subliminality

Although Pötzl did not enter into the matter in detail, it has frequently been assumed that the unnoticed parts of the tachistoscopically exposed stimulus pictures he used were truly subliminal. It should be remembered that Pötzl spoke of two other factors that could keep a stimulus out of awareness, namely, the sinking of the level of attention and the registration of stimuli in peripheral vision. The controversy as to whether in these experiments the stimulus was actually totally outside of awareness began with Allers and Teler who, utilizing Schilder's concept of the "sphere," thought of the stimuli as undergoing registration at a low degree of awareness and being "word distant," i.e., not capable of being described verbally. Allers and Teler criticized the concept of the unconscious, and believed that all stimuli attain some degree of consciousness.

The controversy over subliminality has continued to rage. Most recently, Eriksen (1960) has made a rigorous methodological criticism of many types of subliminal experiments relating to discrimination and learning without awareness, and also has criticized some of the Pötzl-type and "masking" experiments. He concluded that at present there is no convincing evidence that the human organism can discriminate or differentially respond to external stimuli which are at an intensity level too low to elicit a discriminated verbal report. He does not believe that an "assumption of subliminal discrimination" is required to account for the observed phenomena upon which the concept is based, stating that the experimental findings can be explained in terms of the demonstrable partial independence of different response systems to fragmentary perceptual cues and memory traces and/or of lack of awareness of above-threshold cues.

But, as Klein (1959a, 1959b) has stressed, important phenomena are obscured by restricting questions about subliminal stimulation to the issue of whether discrimination is possible without awareness. Study after study has hovered over the point, to what extent was the subject actually aware of at least some feature of the stimulus? The argument advanced by Eriksen and others has been that only a *discriminated* stimulus can affect thought, and discrimination always depends upon at least some information being within the subject's conscious grasp. Klein has emphasized that the only point proved by the critics is that an intention to discriminate cannot occur unless some critical minimal segment of the field is consciously apprehended. In a recent study, Goldberg and Fiss (1959) have demonstrated that this is true; i.e., discrimination, an active attempt to distinguish parts of the field, probably does not occur unless the subject has some degree of awareness, no matter how minimal, of what he is trying to discriminate. In the absence of such an awareness, accurate discrimination does not occur. But if the matter is dropped at this point, important phenomena are obscured and neglected. From the fact that an incidental or subliminal stimulus cannot be discriminated it is not permissable to draw the conclusion that it has been without activating effect. Pötzl's investigation, and all the work since, indicates that there may be delayed effects of a subliminal or incidental stimulus which develop in states of consciousness such as those involved in dreaming, hallucinating, or imaging.

The concentration on the issue of subliminality may lead up a blind alley. Recent studies have been concerned with transient stimuli of all kinds, and there is now a tendency to regard the so-called subliminal stimulus as a special, perhaps extreme case, of what Klein has referred to as "incidental stimulation." The study of stimuli that attain a low degree of awareness is important in itself. However, the issue of the effects of the allegedly *totally* subliminal need not be abandoned. As Eriksen has suggested, the problem has to be approached with more careful controls and more refined psychophysical methods. The investigation of Fiss, Goldberg, and Klein (1960), which was carried out under very carefully controlled conditions, does seem to indicate that a totally subliminal stimulus has effects and may be recovered in subsequent imagery. The observations of Eagle (1959a) and Paul and Fisher (1959) indicate that the best subliminal effects were obtained in those subjects with the highest recognition thresholds, i.e., those in whom the subliminal stimulation seemed to be at the "deepest" level below awareness. These observations cannot easily be dismissed. The matter needs to be settled because the issue of subliminality has important implications for thories of perception, especially those postulating an unconscious preliminary phase of the perceptual process (Fisher, 1957; Smith and Henriksson, 1956; Kragh, 1955; Flavell and Draguns, 1957; and Klein, 1959b).

Subliminal Stimulation in Altered States of Consciousness

Pötzl was the first to observe that altered states of consciousness were especially conducive to the production of aftereffects of subliminal stimulation. Several years before his dream experiment, he demonstrated that tachistoscopic stimuli appeared in the hallucinations of a patient with alcoholic hallucinosis (1915). He postulated that in pathological conditions producing hallucinations or visual agnosias, and in the normal dreaming state, an "abstracting process" is eliminated, with the consequence that a primitive phase of the visual perceptual process emerges into consciousness. Pötzl's work on hallucinations has never been systematically replicated. In 1959 I confirmed his results in a single case of a 13-year-old schizophrenic boy who was having vivid visual hallucinations. This work suggested that when certain ego functions controlling the higher discriminative visual perceptive processes are interfered with, either functionally as in normal sleep, or by brain damage, the more primitive, primary mode of visual perception manifests itself. The important aspect of this primary mode of perception is that it makes use of subliminal stimuli which are transformed in a primary-processlike manner and delivered into consciousness. This suggests that in altered states of consciousness associated with ego regression, the primary mode of perception becomes manifest. Primitivizing agents, such as lysergic acid, which produce ego regressions and schizophrenialike states, should enhance the subliminal effect, as Friedman and I (1960) have demonstrated. States of consciousness other than the ordinary wide-awake, alert type oriented to the accurate discrimination of external reality should be more likely to enhance subliminal activation. Supporting this hypothesis is our report (Fisher and Paul, 1959) that subjects imaging in the dark in the supine position showed greater effects of previous subliminal stimulation than did subjects in the upright position in a lighted room.

In a previous section, it was pointed out that subjects who show a capacity for "regression in the service of the ego" have the greatest subliminal sensitivity. It is also true, however, that subjects who are already regressed, such as hallucinating schizophrenics, have great subliminal sensitivity. It has been suggested that creative persons, with a capacity for regression in the service of the ego in the presence of strong ego controls, are subliminally sensitive and make use of subliminal registrations in their creations (Pine, 1960a). It should be stressed that although creative persons may be subliminally sensitive, this sensitivity does not constitute a full explanation of creativity; subliminal sensitivity is obviously only one among the many ego factors that enter into creativity. The greatest subliminal sensitivity may be shown by regressed psychotics whose ego functioning is severely impaired. I have presented a brief analysis of some of Picasso's works indicating his utilization of primary modes of perception and imagery (Fisher, 1959), and Friedman (1960) has suggested that great composers have utilized similar primary modes in the auditory sphere.

One confusing aspect in this discussion of altered states of consciousness is that we have made comparisons among normal states of consciousness, states brought about by functional disturbances, and states brought about by organic brain disease. One of Pötzl's great contributions was his synthesis of visual perceptual processes involved in normal dreaming, hallucinations, agnosias and other visual disturbances brought about by brain damage, visual processes in eidetic imagery, etc. This synthesis has never been fully reexamined in the light of modern knowledge, and the many leads suggested by his investigation have by no means been followed up. It does not seem, for example, that the neurologists have incorporated his findings into their theories of agnosia. There are also in Pötzl's work implications for the developmental aspects of perception: that is, the visual phenomena he describes represent an early developmental stage of the perceptual process, normally inhibited but released by sleep, by drugs, or by brain damage. Thomas Freeman (1960) has recently attempted to explain, on the basis of the recent findings in subliminal research and Piaget's observations, the manner in which regressed schizophrenics perceive the world. In this connection, we noted earlier that Pötzl called attention to perceptual disturbances in paranoiacs and suggested that such patients show a greater sensitivity to subliminal cues.

Theory

The research on subliminal and other incidental stimuli inspired by the Pötzl and Allers and Teler experiments has received its most extensive theoretical treatment in the writings of Klein and Holt (Klein, 1956, 1957, 1959a, 1959b; Klein and Holt, 1959; Holt, 1958). As has been pointed out, it was Pötzl's hope that his work would form a bridge between the once antithetical disciplines of psychoanalysis and experimental psychology, and also bring these two disciplines closer to neurophysiology. The work of the past ten years by Magoun (1958) and others on the reticular formation of the brain stem has provided a neurophysiological basis for consciousness, making it quite intelligible that cortical function, including that of the sensory projection areas, can go on without awareness. Thus, transmission of a brief or faint stimulus can complete much of the perceptual process, except for the final emergence into awareness which is contributed by impulses from the reticular formation.

Holt (1958) has indicated that Freud was almost unique among psychologists in suggesting that the sensory apparatus has the dual function of making sensations available to us and of protecting us from them. He conceived of a stimulus barrier, *Reizschutz*, which constitutes the first line of defense against overstimulation. The stimulus barrier might be translated today into the general concept of thresholds, which serve the function of screening out the many weak stimuli that might overwhelm us with their quantity if not their intensity. The mechanisms of hypercathexis and attention, as formulated by Freud, provided a second great protector against stimuli. Since there is just so much attention cathexis available at one time, one matter, or at the most a very few, can be hypercathected, all the rest being relegated to various degrees of fringe awareness. As Holt (1958) has put it, "Since the focus of attention is narrow but the scope of man's sensitivities is wide, most sensory inputs must go unnoticed. They comprise the great class of *incidental* stimuli, and include what is subliminal but still registers" (p. 2).

Pötzl's work and all the research since indicates that stimuli which are too weak to attain consciousness and/or attention cathexis nevertheless form memory traces. We do not yet know the conditions for registration, but it seems improbable that every stimulus that is strong enough to activate peripheral sense organs is registered. Hernandez-Peon, Scherrer, and Jouvet (1956) have discovered cortical relay centers which screen and suppress unimportant inputs from the various senses so that the cortex is not continuously cluttered up with routine sensory information. As long as they are unimportant, routine, weak signals, subliminal and incidental stimuli are probably excluded from registration and do not form traces. Holt suggests that novel or unexpected subliminal stimuli have a better chance of attaining registration than familiar stimuli. He also points to motivational variables, specifically the subject's transference relationship to the experimenter, that may determine what gets registered. Another important factor is that incidental or indifferent impressions which resonate with unconscious drives and wishes which transfer mobile cathexis onto them have a better chance of being registered, as the results of the Pötzl experiment have so clearly shown for the dream.

Klein and Holt (1959) have pointed out that by focusing on the effects of nonconscious stimuli, the newer experiments are teaching us something about the functions of consciousness itself. The problem of consciousness is much neglected both in general psychology and in psychoanalysis. Although psychoanalysis has always been primarily a theory of unconscious processes, the problems of perception and consciousness have aroused renewed interest since Hartmann's (1939) stress on the problem of adaptation, the conflict-free sphere, and autonomous ego functions. Recent work implies that when cognitive processes occur without the benefit of hypercathexis, they tend to lack precision and to operate in terms of general schemata and primary-process transformations. Consciousness makes possible precision, continuity, the recording of memories in a system from which they may be recalled by conscious effort, and above all permits focusing on one thing at a time. Stimuli registered without awareness are not recallable in the ordinary sense, even though their memory traces may emerge after a delay in subsequent dreams and images. The hypercathexis of attention creates a hierarchy with respect to what is important in a stimulus for the adaptive purposes of the moment.

The recent work of Rapaport (1957, 1959) on attention cathexis and states of consciousness has theoretical implications for the experiments on subliminal stimulation. Rapaport has emphasized that the older Freudian concept of the system *Cs.* has to be considered as a substructure of the ego of the later structural theory. Consciousness itself can be defined as a cathexis- or attention-dispensing function of the ego system (Klein, 1959b). Rapaport has indicated that there are various levels of consciousness with hypercathexes (attention cathexes) of varying degrees of neutralization. Percepts that obtain sufficient attention cathexis are synthesized and reach consciousness immediately. Stimuli that are weakly cathected with attention are not synthesized and do not reach consciousness. Such stimuli become "recruited" to other processes and may undergo primary-process transformation.

It may be remarked that the above formulation may contain a contradiction, since it seems to equate consciousness with attention cathexis. If this is so, any degree of attention cathexis would result in some degree of consciousness, however slight. This is not to deny the possibility, supported by much empirical data, that a weakly cathected stimulus that attains a low level of consciousness may have the same effects as one that is totally subliminal and completely excluded from consciousness. Klein (1959b) has suggested that the processes responsible for registration seem to be independent of those which govern "attention deployment"; registration and perception would seem to involve distinct processes. This suggestion has received experimental support in a recent investigation by Fiss (1961) who showed that the subliminal effect was not enhanced when subjects were in a nonalert state of consciousness (freely "deployed attention cathexis") during stimulation. That is, subliminal *registration* is not influenced by the distribution of attention cathexis at the moment of stimulation. On the other hand, it was found that subjects in a nonalert state of consciousness showed an enhanced delivery of already registered subliminal stimuli into awareness during the subsequent imagery process. Fiss concluded that the nonalert state influences the "output" but not the "input" phase of percept formation, i.e., does not influence the registration process.

Klein and Holt (1959) summarize the important developments in the research that has followed in Pötzl's wake in the following propositions:

1. Registration is possible without awareness as usually defined. As has been indicated earlier, we cannot be certain that in Pötzl's investigation and in the several replications of it the stimuli were subliminal in the sense of the most sophisticated psychological criteria. It is certain, however, that in this work the brief stimuli were not focal and attended to. They are best referred to as marginal or incidental stimuli. It is also to be noted that we do not speak of "preconscious perception" or "subception," but of "registration" outside of awareness. The perceptual process is considered to be complex, extended in time, and the initial phase of it to occur outside of consciousness. What is ordinarily called "perception" refers to the final conscious phase of this complex process.

2. The registrations of incidental stimuli can be recovered in a variety of modes of experience and behavior. Aside from recovery in dreams, images, and hallucinations, it has been shown that reaction time and verbalizations may show the impact of subliminal stimulation. Spence (1960) has reported effects of subliminal stimulation on recall, decision time, and discrimination. There are a variety of states of consciousness, not all of them showing the same capacity for the recovery of subliminal stimuli. In the ordinary

alert waking state such registrations do not emerge directly as percepts. Recovery of subliminal input seems to be more easily achieved by asking subjects to image. Dream, hypnotic, hypnagogic, mescaline, and LSD states permit a ready emergence of subliminal registrations. In all these states reality contact and reality requirements are minimized so attention cathexis can be directed to registrations. They can be brought to awareness after a delay in a passive imagelike manner. It appears that all ways of minimizing reality-adapted intentions facilitate the emergence of subliminal registrations.

3. An incidental stimulus that makes contact with an active drive schema seems to be especially likely to be recovered. The original Pötzl experiment and all the replications of it have clearly shown that subliminal registrations are recruited into active drive schemata, influenced by unconscious wishes, and subject to primary-process transformation.

4. The recovered incidental stimulus is rarely a literal replica of the stimulus but a transformed variant of it reflecting the conceptual and drive schemata in which it has become implicated. My work especially has shown that subliminal visual stimuli are subjected to a variety of distortions and transformations, at least ten of which have been enumerated. However, in some instances there is a clear photographic emergence of the stimulus, and the problem of the presence or absence of transformation needs further investigation. Furthermore, I have raised the issue (1954, 1956), which has not yet been sufficiently explored, of the nature and origin of these transformations. For example, are they products of the natural "decay" of the memory traces of subliminal registrations, or are they brought about by interaction with a drive schema with its accompanying primary-process activity?

5. The fate of an incidental stimulus is distinctly different from the fate of a stimulus in the focus of awareness. A good deal of the work that has been discussed indicates that subliminal stimuli are recruited into the drive organization of memories and undergo primary-process transformation, while focal stimuli that command attention are recruited into conceptual secondary-process schemata. I have shown (1960), however, that this is not strictly true, and further investigation of this problem is needed.

6. Certain states of consciousness, certain types of stimuli, and

certain types of ego structure facilitate the recovery of marginal or incidental stimuli.

The implications of the recent work on subliminal and incidental stimuli for the psychology of the dream process have not been gone into in detail but have been most extensively discussed by me in other papers (Fisher, 1954, 1956, 1957, 1960; Fisher and Paul, 1959). In concluding, it can be seen that the investigations of Pötzl and Allers and Teler have stimulated a great deal of experimentation which is relevant to psychoanalytic ego psychology and which has thrown light on the functioning of the ego apparatuses of perception and memory, consciousness, attention, the primary and secondary thought processes, the role of subliminal incidental stimuli in altered states of consciousness, the creative process, and the psychology of dreaming.

1

THE RELATIONSHIP BETWEEN EXPERIMENTALLY INDUCED DREAM IMAGES AND INDIRECT VISION

OTTO PÖTZL

I. RELATIONSHIPS [BETWEEN THESE EXPERIMENTS AND] DISORDERS OF THE VISUAL SPHERE

Investigations of relative paracentral scotomata resulting from occipital gunshot injuries have clarified the phenomena of interference between the percepts which originate in the intact part of the visual field and the relatively significant, but delayed and altered, visual residues which originate in the scotomatized region. It has become clear how, in normal visual conditions, such residues are excluded from conscious perception by an abstracting process. This process is independent of will and consciousness, and is similar to the process which gradually suppresses the diplopia in acute eye-muscle paralysis.[1]

Quite often, after gunshot injuries to the visual regions, so-called physiological diplopia arises.[2] The patient often becomes more than usually aware of the impressions which originate in indirect vision, for instance, the peripheral precolors. Finally, such patients fre-

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[1] Vienna Psychiatric and Neurological Association, April, 1917. The abstracts of the author's publications referred to in the text will be found in the review section of the *Zeitschrift für die gesamte Neurologie und Psychiatrie* (Berlin: Springer), 1917.

[2] See communication of February, 1917.

First published in *Z. Neurol. Psychiat.*, 37:278-349, 1917.

quently apperceive the blind spot during perimetry; often its area is enlarged, probably owing to rigid fixation. All these phenomena point to a central disturbance of the abstracting process, in which perceptions become conscious which can otherwise be elicited only by special methods and training. All this adds up to a factor which is, in a sense, in conflict with the influences already discussed.[3]

An autopsy finding[4] suggests that in such cases the small, relative, central and paracentral scotomata are related to an extensive lesion in the medial region around the pole of one of the occipital lobes. It became evident that there is a certain inverse relationship between the configuration of the lesion and the configuration of the visual field. The lesion broadens toward those parts of the visual area which are around the pole, while the anterior parts of the lobe are intact; the paracentral scotoma narrows toward the center of the region of fixation. And yet, considering the kind of disorder, we can relate it only to the injury of the polar region. It follows that we can expect a total loss of central direct vision, with preserved peripheral and indirect vision, even from an occipital shot wound only if it is polar and causes very extensive bilateral destruction of the medial areas of the visual sphere, and especially if it is accompanied—as severe injuries usually are—by a general restriction of functioning, which, however, is directly related to the particular region of the brain that is severely damaged.

Thus it was to be anticipated that total loss of central direct vision, of which no, or at least no unquestionable, cases of nontraumatic etiology were observed, would be extremely rare even in cases of shot wounds to the occiput, but would sometimes occur. This expectation has been confirmed by experience. So far only two carefully examined cases of this sort have been reported, one of them by the present author,[5] and the other by Poppelreuter (the case of Bernhard Fischer[6]).

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[3] [Pötzl seems to refer to the influences which tend to suppress the visual residues originating in the scotoma.—*Tr.*]

[4] Lt.-Pl., reported April, 1917.

[5] Obszut, December, 1915.

[6] Poppelreuter (1917, pp. 54-57). The author mentions (p. 59) that he has learned by word of mouth of two more cases. The recently published Seventh Volume of Wilbrand and Saenger (1917), *Die Neurologie des Auges*, contains a pertinent case (Steenböck, p. 111, and p. 597); and Case IV (Axenfeld) may also be relevant. But since no sensoriphysiological details, except for data concerning the visual field, are reported in these cases, I cannot consider them in this discussion.

The characteristics that these two cases have in common are significant for the physiology of vision. Both patients have only indirect vision: only peripheral parts of their visual fields are preserved. Nevertheless, unlike the common cases of central scotoma due to retrobulbar neuritis of the ophthalmic nerves, they are capable of performances in indirect vision which are otherwise found only in direct vision. The form perception, color perception, and ability to read of these patients are at a level which at first seems astonishing. The neuropathology of the brain, however, offers an explanation, since it shows that these processes depend on the functioning of the entire visual region, rather than on the central visual region. I have demonstrated this in my investigations of cases of agnosia, particularly for form and color perception.[7]

If the act of visual perception as it occurs in the field of vision and in the field of eye movement is studied, experience with occipital shot wounds seems to show that the performance in central vision can sink to levels like those in peripheral vision. This is demonstrated by, among other things, the character of the visual residues in cases of relative paracentral scotoma and by the behavior of patients whose impairment is midway between this condition and total loss of macular vision.[8] But the same observations also show that performance in peripheral vision can rise to levels quite similar to those in central vision.

In what follows we will not consider the regressive side of this relationship, but rather the progressive side, which is clearest in the performances of the two patients mentioned, since they certainly had only peripheral vision.

For this side of the matter, Poppelreuter's patient represents the final outcome of this progress, since his condition seemed to be stable, and since all we know about the regeneration of his vision is that it slowly came about from a seemingly hopeless state. My own case, however, came under observation in the first stage, and has been continuously observed for the last two years. In this period the patient showed all the phases of this evolution, which is, in my opinion, still in progress. Thus my case and Poppelreuter's relate to one another as does the path to the destination.

In the early phases of his regeneration, Obszut displayed a conspicuous, peculiar form of vision, in which fragments of impressions, spatially and temporally completely separated, emerged into consciousness in a delayed and piecemeal way. Two examples will be enough to illustrate this: A military decoration—a gold cross on a white field—is shown to the patient against a dark background. He sees only the white field. When all this is removed and replaced by a dark surface, the patient makes the labored focusing movements which he uses to bring an object into his residual peripheral visual field, and says, "A cross, yellow," indicating the shape by pantomine.

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[7] Reported by the author in 1912, 1913.

[8] The case of Lesniak, reported by the author in March, 1917.

He is shown a bouquet of flowers, from which a conspicuously long, thin stalk of asparagus is sticking out. He sees only the red rose, in keeping with his predilection for red. Now the bouquet is removed and the patient is asked to identify the regimental color on the collar of an officer who is present. By his forced focusing movements he manages to bring the neck of the subject into his residual visual field, and says, "A green tiepin."

Numerous instances show the consistency of the mechanism by which Obszut correctly perceived impressions of forms—similar to positive afterimages—after a delay, but without relation to the exposure from which they arose. These delayed developments, just like dream images, undergo all sorts of condensations. It appeared, then, that at this stage, indirect vision can achieve vision of forms only by a delayed, piecemeal delivery of successive fragments, while later it can bring this about in a simultaneous and unified way, like the direct vision of normal people. This gave a hint as to the nature of this evolution of indirect vision and of the intermediate steps in it, especially in regard to rhythm and tempo.

From my investigations of agnosias, I was familiar with this delayed delivery of piecemeal impressions other than that which occurs in tachistoscopic experiments with normal subjects (see, e.g., Schumann, 1907, p. 167). In tachistoscopic exposures to normal experimental subjects, however, we are dealing with impressions of parts which, although they make a delayed appearance at successive intervals, do nevertheless fuse with the exposed complex. In cases of agnosia, at least if they are severe, this subsequent fusion is not frequent, but the reactions occur without direct vision having been destroyed. Obszut's behavior and that of agnosics differ clinically in other characteristics also, but we cannot discuss these here.

Moreover, I have found the same transformation in perception of tachistoscopic exposures in a case of latent hemianopsia and alcoholic hallucinosis, under rigorously controlled experimental conditions, in which the subject was unaware of the purpose of the procedure.[9] Here I will summarize only the findings of that series of experiments which have a direct relevance in our present context.

In this subject, hallucinations were not elicited by prolonged exposures of objects and pictures, but regularly appeared after very short exposures—that is, the same condition in which normal subjects make their agnosialike mistakes.

These hallucinations appeared as a completely discontinuous series of single images without any psychological[10] connection between them. They were separated by pauses at least several seconds long, followed the rhythm of afterimages, and, although they were periodic, the length of the intervals varied above the lower limit mentioned, depending both on the experimental conditions and on internal factors.

The less the subject perceived of the exposed complex, the richer were the hallucinations. Several hundred experiments show that everything perceived at the time of the exposure was completely excluded from the contents of the subsequent hallucinations. These hallucinations were therefore like positive afterimages of parts of the original stimulation, but essentially they were negative afterimages of the original apperception. Each hallucination corresponded to a small portion of the visual configuration presented. They had the characteristics of dream images that Freud has pointed out: condensations and displacements. They also showed very striking mirror images and spatial transpositions, which gave them some of the characteristics of metamorphopsia.

Some of the experiments were carried out in a perimetric setup, and showed that the hallucinations also reproduced parts of the exposed image which were perceived in indirect vision. This fact is related to the findings in the Obszut case. It shows that in the presence of a general disturbance of the abstracting process, as in the patient mentioned above,[11] the impressions originating in indirect vision can rise to a fully clear sensory form in a succession of delayed and piecemeal fragments.

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[9] Reported by the author in December, 1913.

[10] [By "psychological" Pötzl probably means "conscious."—*Tr.*]

This leads to an assumption which is perhaps obvious, namely, that the development which we have described takes place in normal people too, but the abstracting process prevents its becoming conscious, as this happens with the visual residues of the relative scotoma. We could hardly assume that a destruction of parts of the visual sphere or psychological disturbances which interfere with the abstracting process (Berze) could give rise to a development which is not preformed in the organism. Moreover, in normal people there is a condition—namely, the dream—in which this abstracting process is inactive, at least to a great extent. For these reasons, in the last few months I have investigated the effect on a series of normal subjects of the same experimental setup which brought about dream images and hallucinations in the above-discussed case of hallucinosis in semisleep. Although the well-known observations of Johannes Müller, Purkinje, and Helmholtz, as well as the experiments of Urbantschitsch, have not so far been systematically developed and organized, they indicate what results could be obtained from such an investigation. I used this procedure to clarify, at least by illustration, the process which in cerebrally determined impairments of central vision gradually invests indirect vision with the characteristics of direct vision, and is thus very similar to the processes which create a pseudofovea in peripheral disorders of the visual apparatus.

II. SOME EXPERIMENTS ON REACTIONS IN DREAMS TO VISUAL PERCEPTIONS

The subjects were kept in complete ignorance of the purpose of the experiment. The series of slides used was prepared by the Reichert company.[1] They were not known to the public, and I myself saw them for the first time in the course of the experiments. In general, a picture was used in only one experiment. The subjects were chosen from the most varied backgrounds and, with one exception, each served in only one experiment.[2] I chose subjects who were inclined to watch their dreams carefully and who were willing to interrupt their sleep to take notes immediately, as I wanted to avoid arousal stimuli. In general I did not use subjects who were interested in Freudian dream analysis, since I wanted to carry out these experiments with people as little familiar with the mechanism of dreams as possible.

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[11] Cf. Berze's (1903) theory of paranoia.

[1] I wish to express my warmest thanks to the Reichert company for its generous help.

A few of the experiments were carried out in a perimetric setup, to insure that the stimulation occurred in just those parts of the visual field which were the residual visual field in our two cases who had lost central vision. The majority of the experiments were carried out in central vision. The basic experiment consisted of one exposure at ⅟₁₀₀ sec. The figure ⅟₁₀₀ sec. is the time shown on the compound shutter used; it indicates the order of magnitude of the exposure rather than the exact length of time.[3]

I used only twelve subjects, since in most of the subjects every detail of the phenomena appeared regularly. The dream images of nine of the twelve subjects were clearly influenced by the tachistoscopic exposure. An inspection of the slides showed conclusively that, in the dream images, the visual groups which appeared true to form or in an easily recognizable form were the very ones which had apparently not been seen at the moment of exposure and did not occur to the subjects even afterwards. The same thing happened in the perimetrically carried-out experiments with the groups of forms which were, as described above, in the field of indirect vision but were not apperceived.

In what follows I will describe and comment on some of these experiments. It should be noted that the dreams which occurred during these experiments could be fully understood only by means of Freudian dream analysis. Since here I am mainly concerned with sensoriphysiological relationships, I will not discuss in detail the sometimes very complex psychoanalytic relationships involved in these dreams, and will present only fragments of some of the dreams and hallucinations.

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[2] After the present paper was completed, I carried out a second experiment with a second case of visual disturbance following an occipital shot wound. This experiment was undertaken to answer a specific question, and is not relevant to what follows here.

[3] [Apparently Pötzl did not measure the exposure time, and accepted the calibration of a standard photographic camera shutter.—*Tr.*]

The procedure followed in each of the experiments reported here excluded the possibility that any kind of suggestion might influence the results. The slide, which was unquestionably unfamiliar to the subject, was exposed only once, for $\frac{1}{100}$ sec. Then everything the subject believed he had perceived was recorded, the subject receiving no help of any kind in this. Everything[4] that occurred to the subject during the day was put into a second record. The subject was instructed to watch his dreams and hypnagogic hallucinations during the following night. Subsequent dreams were ignored. The purpose of this limitation was to establish a simple and well-defined situation, even though, considering the inertia of these delayed effects, some images might well be lost, and the rhythm of any delayed material is a problem which deserves investigation. The following day the dream images and hypnagogic hallucinations were put into a third record. In order to keep these free from other influences, arousal stimuli and the like were avoided, except in so far as they occurred accidentally. The subjects were instructed, however, to think through their dreams and to write them down, immediately after awakening if possible. Despite the risk that a large part of the material might be forgotten and lost, during sleep no stimuli were introduced into the experiment.[5] The set established by the experimental procedure itself seemed to me a guarantee that enough material would be left. In addition, my experimental aim did not require positive results with all the subjects; a few positive findings are enough to establish the sensoriphysiological validity of the results. The fact that almost all the subjects readily produced strikingly rich results came to some extent as a surprise to me.

Part of the third record, therefore, was already in writing when the subjects came to see me the next day. To complete these records the subjects were asked to give further associations and again were given no help. The only thing I asked of the subjects was to draw simple sketches of certain particularly prominent visual dream fragments. It takes a certain amount of intuition to sense what should be sketched, but probably this is soon developed with experience.

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[4] [Presumably Pötzl means "Everything relevant to the experiment."—*Tr.*]

[5] [Pötzl apparently means that by arousing the subject repeatedly during the critical night a fuller dream record could have been obtained.—*Tr.*]

Thus the whole record of the dream was finished before the subject was shown his slide again and before I myself inspected it. A careful reading of the experiments will indicate that even after a record was completed I usually had no way of knowing whether or not the experiment had yielded positive results, and what correspondences it showed. This was indeed the case. In the description of each experiment, what the subject added about the dream after having seen his slide will always be labeled as subsequently recorded. All material not so labeled was described or drawn by the subject under no other possible influence than the single exposure at 1/100 sec.

After the third record was completed, I inspected the slide, usually alone, as it was originally projected. After this inspection, the subject and I looked at it together.

Here I will describe only the part of the experiments which I have already presented elsewhere, and will follow the same sequence.

First Experiment (2/18/1917, 8:00 P.M.)

> The slide exposed for 1/100 sec. represents temple ruins at Thebes, near Medinet Habu, Egypt. It is shown upside down.
>
> The sharp narrow shadows cast by the columns and plyons happen to take the form of reversed L's, e.g., ⅃, etc.; another shadow, more to the right, looks like a black flag. A shadow to the far right, in a narrow split in the wall, looks like the black silhouette of a tall human figure, with something like a crown of curly dark hair.
>
> The subject reports: "Writing. Like hieroglyphics. To the right a large letter, wide at the top, and then narrowing down . . . The background is light. Like something written in the desert." He adds later: "Sort of a sunny background."
>
> Subsequently the subject thought of a cigaret advertisement with pyramids in the background. But he did not know whether this had anything to do with the matter at hand.
>
> In the dream report: Nothing about any of this. Besides, he fell asleep late and his sleep was restless. Toward morning the subject dreamed that in passing a certain garden he had seen X. The garden looked "as usual."
>
> (Nothing else?) "Yes, I wanted to tell you something but I have forgotten it . . ., yes, it came back to me later; there was a wall there, and Y stood at the edge of it. We talked about—."
>
> The subject is asked to sketch the wall and Y's position. He draws more than he was asked for, in that he executes Y's contours in a peculiar way.

At this point I inspected the slide: the long foundation wall of the temple ruin which stretches across the entire picture is faithfully reproduced in the drawing, with indications of its masonry. The only thing missing is the black rectangular surface of the flaglike shadow ("letter, wide on top . . ."). It is excluded from the dream image since it had already been developed in the waking state. Instead of it, there appears the shadow resembling a human figure which corresponds to the part of the slide to the right of the "letter"; this had not been noticed, and, like Obszut's reactions, makes a delayed appearance, but in this case in the dream image.

Y, the [second] person in the dream, is tall, thin, and dark; her coiffure is such that it completes the impression that the shadow on the slide could well be Y's shadow against a wall. The subject's drawing, which reproduces all the details of this shadow, could have been derived only from the figure in the picture, not from a memory image of Y or of her silhouette. Y is a woman, but she is not represented as one (Fig. 4).

The associations provide a series of correspondences which explain why the exposure was seen as writing. The structure of the dream yields a number of further correspondences. I cannot discuss these relationships here, and will mention only that all the situations which proved, without forcing, to correspond to the groups of dream images, were, just like the groups which appeared in the slide, unconsciously perceived day residues of the recent past. Unconscious experiences corresponded to material which was unconsciously experienced, and conscious perceptions to material which was consciously perceived. It was possible to show this conclusively, owing to a particular constellation of circumstances. Congruent geometrical forms mediated between these correspondences.

The experiment demonstrates, first of all, the existence in a normal subject of the same delayed development of parts of preconsciously perceived visual material which I observed in Obszut. And here the relationship of mutual exclusion which was observed in the case of hallucinosis appears between the consciously experienced percepts and the unconsciously experienced ones which emerged in dreams.

Second Experiment (3/16/1917, 8:00 P.M.)

The subject is a wounded officer with slight asthenopia, resulting from a concussion inflicted by a blow to the occiput. He has no specific disorder of vision. Visual perception is somewhat slow, and the positive afterimages tend to be obtrusive and annoying, particularly in the course of falling asleep.

The slide used shows Jews praying at the Wailing Wall. The walls and the paved court are glaringly white. In the background the square black silhouette of a door stands out sharply. To the left, a number of people in variously colored clothing are standing along the wall; they are all leaning against it, many with arms upraised.

As was expected from a tachistoscopic test which showed the sluggishness of his visual perception, the patient saw particularly little in $\frac{1}{100}$ sec., even less than the subjects who had no experience with the tachistoscope.

"I saw something; it is impossible to say what. Just black and white." After a pause: "Shadows; long stripes . . ." Later: "Like trees."

There are actually trees in the upper part of the background. He could not have perceived that they are green, since the exposure time was a tenth of the threshold for the perception of this color. This part of the background does not appear in the dream, but indicates the region from which the dream development of the unconsciously perceived parts of the slide begins, and spreads into the neighboring regions.

As was to be expected, the record of the dream yields an abundance of hypnagogic hallucinations, not real dreams. A long series of these, particularly those which the subject mentioned first, can be fully explained by proved day residues; not until after these does the first correspondence appear in the record, as if indicating that the dream development of the exposure required time even during this halfsleep, or that it corresponds to a deeper level of halfsleep:

"A sea with a large steamer. I don't know where I got it from. But this too has changed. At first the sea was rather high. Really a very pretty picture. The water, the waves, shimmering white [Fig. 7a]. The ship was completely black and only the front part, prow and smokestacks, was visible . . . they were vertical . . .

"But there weren't any people on it . . .

"Later on it changed. The ship was much larger . . . seen from the side . . . completely white . . . no people on it.

"Then this picture changed. There were a great many people on it, very tiny, like dots; in vivid motion. I saw the arms . . . moving . . . as if they were waving something . . . shawls or something like that. The arms were too big for the figures."

The subject was asked to draw the two positions in which the ship appeared, and which he had already described.

The subject drew first the square black form of the hull with smokestack. Later, in checking the report against the slide, I immediately recognized this as the silhouette of the door, that is, the part adjacent to the consciously perceived black and white area which, along with the contours of the trees which were perceived consciously but only vaguely and after some delay, form the background of the picture. The direction of this background corresponds to the vanishing point of the picture.

Next the subject draws the ship as it appeared to him later—as he now says, "when it came closer"—white, in full front view,[6] but without people.

What is sketched here can also be discovered in the slide, but it is like an embedded picture,[7] and special practice in searching for such embedded pictures is necessary to discern the relationship between slide and sketch. In following this relationship, the eye will travel along a line composed of two merging horizontals of different spatial directions which go from the vanishing point to the foreground of the picture. It should be noted that in the dream the ship comes closer, so that there seems to be a kind of relativity between a virtual eye movement and the movement in the dream image.

I could not treat this example in such detail if my hundreds of experiments with H.[8] had not shown me the lawful regularity with which every single hallucination contains a geometrically true but at first hidden correspondence with the exposed visual complex. In inspecting the slide one must search for them, just as for any embedded picture. As in those, here too a constellation, once it has been found, becomes so obtrusive that in continued viewing of the picture one at first cannot shake it off.[9]

It need hardly be pointed out that the virtual eye movement mentioned, in this instance a virtual convergence given by the perspective of the picture, could not actually have occurred during the exposure but could only have begun. The minimum time for eye movements is, even in normal people, more than ten times the exposure time used here.

The third phase of the dream image is again easily discovered in the slide and requires no comment. It reproduces the row of people standing at the wall with raised arms. The virtual movement of the eye is directed toward the foreground. In the dream the ship came closer, opened up, and people appeared on the deck. The movement of the arms again represents a potential movement which is obviously implied in the posture of the human figures exposed in the slide but not recognized by the subject. Even the very fact that the arms appear too long in comparison to the bodies corresponds to the striped armlike shadows on the wall in the slide.

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[6] [The "side view" is now referred to as "front view."—*Tr.*]

[7] [Throughout this paper, "embedded picture" translates *Vexierbild.*—*Tr.*]

[8] [The hallucinosis case.—*Tr.*]

[9] See Wertheimer (1912, p. 92). At a demonstration of these experiments to the Vienna Psychoanalytic Association (May, 1917), my attention was called to a study by Pfister (1913) on unconsciously produced embedded pictures in artists' paintings.

It is interesting to note the patient's reaction when we looked at the slide together. He recognizes the black contour of the ship as the door without much interest: "Probably by using this . . ." He turns immediately to the people at the wall, whom he identifies as the figures on the ship:

"That is just the way they are on the ship. They are all leaning against the railing."

Only at this point do I recognize the railing: it is a horizontal, inconspicuous, yet once it is pointed out perfectly recognizable, ledge, which immediately becomes a railing if one disregards the upper part of the wall (which is, as I see it, the left half of the white hull of the ship in the second phase [of the dream]).

This corresponds exactly to the phenomenon which I described as regularly occurring in hallucinosis and in agnosia, and which I also observed during Obszut's recovery: namely, in each of the impressions of parts which appear in visual hallucinations, *isolated* bits of the visual complex emerge successively, without fusing with each other.

"Even the position of the arms is right." (The subject imitates it.) "They were all holding their arms forward, like the people in the picture, as though they were waving something, handkerchiefs, for instance. I saw the open ship and mainly this" (he outlines the courtyard in the picture as though it were an open deck) "with people at the railing." He repeats that he saw them in motion, and remembers them as being dark, without colors.

In the case of H., the subject with hallucinosis, the last and weakest hallucinatory derivatives of each exposure were always in motion: usually the last thing to come was just a quick, fleetingly seen movement, a swish, a push. In sensoriphysiological terms, the behavior of this dream image is in good accord with an impression from a tachistoscopic exposure of very short duration. If we consider that in projection all white surfaces appear to be brightly glaring, the white and wildly moving image of the sea becomes understandable.

The patient surmises that the day residues involved in the development of the slide in the dream were pictures of submarine warfare in illustrated magazines. Inspection of such pictures published in the relevant time period yielded no spatial-visual correspondences like the ones found in the slide used in the experiment.

In addition to confirming the results of the first experiment, this experiment shows the successive appearance of three phases, which correspond to the three simultaneously exposed parts of the slide. Simultaneity is thus transformed into successiveness, and what holds the parts together, the overview,[10] is transformed into movement in the dream. This interchangeability of motion, space, and form will be amply illustrated in the following experiments.

Third Experiment (3/26/1917, 11:00 A.M.)

The slide shows the railroad station at Aswan, and is in color, like all the other slides used.

To the left is the long, low station building, whose wooden columns seem to partition it into shops, like a bazaar. There are many people in front of it. Adjacent to it, the foreground is filled by the wide platform; further back a crowd is pushing toward the train. In the background is the entire length of a bridge similar to the bridges in many western railroad stations. It spans the tracks, whose vanishing point is at the extreme right of the picture. The tracks are cut off from view at the bridge by the locomotive of the train, around which the people are crowding. The locomotive is clearly seen head-on, with smokestack and red headlight. In the foreground, by the tracks, there are a few pieces of luggage on the empty part of the platform.

The subject reports: "Lots of shops. Stores. Lots of people in front of them. A gap[11] between them." The subject indicates in pantomime that there seem to be buildings to the right and left, with something in between. The subject confirms this interpretation of her gesture.

In the afternoon the subject believed she remembered having seen two tall buildings to the right and left; this, however, may simply be an assimilation of the memory of her impression to familiar street scenes. "And the gap between them keeps coming to my mind. And there were not many people in the picture, not more than three or four, toward the foreground." This second distortion of memory may be explained by a delayed development of the frontmost group of people boarding the train.

The next morning, before the dream record is taken, the subject is asked to relate once more everything that she connects with the exposure.

"First, those two high places. On the left it was like a long street (the platform). There were three people in front, the ones on the right and on the left were tall, the middle one more to the front was shorter."

As the dream record, the subject reports: "Toward morning . . . but this is irrelevant" (she smiles) "I went into a store on this street. It occurs to me: these three people . . ." (from the picture?). "A little man; he wants to stab me in the chest with a knife. But there is a brook near by. I snatch the knife out of his hand and throw it in. Then what happened was that a child came to the brook, took the knife out of it, but now it was much larger than before; the man was very excited . . ."

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[10] ["Overview" translates *Überblick*. Pötzl seems to mean the eye movement by which the subject obtains an encompassing view of the picture. The German word connotes "survey"; Pötzl's use of it seems to imply "synthesis" as well.—*Tr.*]

[11] ["Gap" translates *Durchbruch*, literally "break-through."—*Tr.*]

This point, which is psychoanalytically transparent, does not, on the face of it, have any correspondence with the slide.[12]

"Then I escaped into a house and a lady took me in and took care of me."

This ends the subject's description of her dream. It is reproduced here verbatim, as she gave it without any help. It is an easily analyzed knife dream of a common type. We will see that it has correspondences in the slide.

The subject is first asked to draw her dream impression of the street. She draws converging lines which are obviously identical with the unconsciously perceived tracks. At the end of the street (that is, of the tracks) she draws, without prompting, the little house from the dream; she indicates a door in front and wants to draw a chimney. The locomotive, which is standing at the end of the tracks in the slide, is recognizable in the sketch of the house.

We need not discuss the symbolism which, according to Freudian analysis, may be assumed here. But there can be no doubt that the visual structure of this dream image is derived from the slide.

The subject is now asked what the drawing means, and no more. After [finishing] the drawing she says: "The street was wide and then narrowed; it was as if it would never end." Here too, just as in Experiment II, there is a clear relation to the parallels which converge in the perspective and to the vanishing point of the picture. Here, however, the vanishing points in the dream image and in the slide are identical. Obviously, therefore, the overview initiated [by the tachistoscopic exposure] would in this case move from the foreground toward the vanishing point. In the dream the subject herself moves in that direction. This new relationship between the eye movement and the dream movement is also supported by the fact that the people who are boarding the train are moving in the same direction, as their posture on the slide indicates. Thus the dream movement and the overview both progress toward the background of the picture, just where the locomotive is on the slide, and the little house, which corresponds to it, is in the dream.

But the brook is still to be found. If one wishes, one can easily identify it in the railroad embankment. This relationship was not apparent at the time, since I had not yet inspected the slide, but

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[12] But later, in the illustration of the experiment (see Section 3, Experiment III) we do encounter a possible correspondence.

> the answers to some questions which were asked at this point tend to confirm it.
>
> (Do you remember the scene at the brook in the dream?) "Yes . . . looked like a bridge . . . up high, and I threw it [the knife] into the depths . . . there may have been some water below."
>
> (A bridge?) "Yes . . . it was long . . . and very wide."
>
> Asked whether the picture was in color, the subject answers that it was not. When asked specifically about red, the subject looks perplexed and says, with hesitation: "Yes, the bayonet? . . . I didn't see any blood . . . because I immediately snatched the knife away and threw it into the brook."
>
> Later inspection showed that there actually are red areas on the slide. I myself vaguely remembered them from the exposure; I knew them from a most brief and fleeting preliminary inspection of the slide. The exposure time was much too short for the subject to recognize the color during the experiment. One of the red spots belongs to the figure of a lady in a blood-red coat, who seems to be hurrying with the other people toward the train. The other red spot is the round headlight on the locomotive.
>
> In the crowd we find, drawn as precisely as an embedded picture,[13] the outlines of a man with a knife, which seems to be pointed at the chest of a woman dressed in white. For the moment I will disregard these relationships in evaluating the experiments, and will point out only those correspondences which are compelling and cannot be overlooked by any objective observer. They are: railroad tracks ⇄ street; locomotive ⇄ house; bridge.

The subject of course verifies these correspondences as soon as she looks at the slide. In these experiments, just as in Freudian dream analysis, the subject is moved by the correct obvious relationships when they come to mind. The unquestionable correspondences in this second example confirm the relationship between the visual groups in the slide, the virtual eye movements of the overview initiated by them, and the direction of movement in the dream. In addition, the experiment shows once again the relationship of exclusion between the consciously perceived and the unconsciously dreamed. These two sharply distinct groups are connected only by distortions of memory, which, as everyday psychological experience shows, seem to contain elements of both.

A comparison of the second and third experiments shows that, in both, the part of the slide which was perceived in the waking state and excluded from the dream development was the starting point for the eye movements which we are assuming here. The apperception in the first experiment calls attention to the fact that the subject's set,[14] and the lingering of his visual fixation, are of course not always accidental. The selection of partial impressions from the slide and the shaping of them into a new individual unity is determined at least sometimes by previous experience and the influence of past correspondences, and sometimes by the perspective [of the stimulus picture].

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[13] [Pötzl is obviously referring to an accidental configuration.—*Tr.*]

Fourth Experiment (4/4/1917, 7:00 P.M).

> The subject is the same as in Experiment III. The subject was the only one to serve in two experiments. This exception was made for the special purpose of using this subject, who reacted well, not only in the condition of minimum exposure time, but also in the condition of indirect vision, which focuses the investigation more closely on the transformation of indirect vision into central vision. Experiment IV took place at a time when the existence of and the details of this transformation had already been definitely established. The exception therefore did not violate the principle which was adhered to from the beginning, namely, that the subject be unaware of the purpose of the experiment.
>
> The experiment took place in a perimetric setup. The subject fixated binocularly so as to ensure that the exposure would not fall on the inner 20° of the binocular visual field. The slide was exposed to the right, in indirect vision, so that at the instant of exposure the view filled approximately the outer 50° to 60° of the visual field.
>
> A colored slide, showing a Cook steamer on the river Nile near Aswan, was exposed once for 1/100 second. I pretested the effect of this slide in continuous exposure in indirect vision on other subjects, none of whom this subject knew. The results showed that the two white sails, with the deck and its row of portholes, frequently gave the general impression of a house with a gable roof.
>
> This subject reacted in the same way at the 1/100 second exposure: "A small house. Two rows of windows, a lot of them, side by side. Otherwise . . . nothing else." No subsequent additional ideas.
>
> A dream the following night, toward morning, is reported as follows:
>
> "[I] was walking along a very wide forest path with two young ladies. At the end of the path there was a great deal of undergrowth, a jungle of brambles. One of my companions got lost in the woods, took a road to the left; [that was] the young lady who was still with me; I lost the other one completely.

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[14] [*Einstellung.—Tr.*]

"Then I was on top of a hill; I asked the young lady who was still with me whether or not she wanted to go into the house with the many windows [which was] visible in the distance."

(The subject laughs.) "Did she intend to stay in the forest to gather wood . . ."

(Then?) "Only one thing; I went into the house and sat down in a little niche at the window . . ."

(The house?) "It seemed different from the way it looked in the picture; it was much longer, it had an attic but no roof."

The sketches the subject made show that the roof seen in the waking state was made up of the two triangular sails (of which she drew only the one closer to the region of fixation) and of the part of the ship which lay between them. This roof was missing; instead there was an attic, and "the windows were closer together."

(The forest path?) "A beautiful straight path, rather narrow, so that two people could walk on it. There were just bushes on the sides. Everything was green, as in spring."

Again we will forego discussing the psychoanalytic implications of the dream. To compare it with the slide is very easy. The shore of the Nile—just that part of the picture which during the exposure fell in the right half of the horizontal meridian[15] of the visual field—contains, in regard to both configuration and direction, true to the evidence,[16] all the details of the dream picture, and also the dream movement in the form of a spatial arrangement.

Next to the riverbank is a narrow strip, lined with shrubbery, in the exaggerated green of Lumière slides. This corresponds to the forest path. In just the region where the second triangular sail cuts the shoreline—in the picture—is a shape on the shore which represents the thorny underbrush in the form of an embedded picture. In the perimetric setup this point fell somewhere between the 35° and 40° parallels.

All this is immediately and unquestionably discernible. If one wishes to use the art of interpretation, one can imagine, in the delayed development of this part of the picture, a break at the point where the shoreline is cut by the first triangular sail, which was seen in the waking state and was discharged in the drawing of the alleged outline of the roof. If we transform the direction of the dream movement into the direction taken by the delayed development, it becomes apparent that the path taken by the dreaming person corresponds to the direction of the delayed development both in the picture and in the visual field. Here the direction of movement contained in the picture and the direction of a meridian of the visual field coincide. These two can work in the same direction, in which case the break of the sail points to the left—relative to the direction of the path—that is, in the direction in which the companion disappeared in the dream. The two breaks made by the sails may correspond to the two companions, etc.

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[15] [*Rechten Horizontalmeridian,* literally "right horizontal meridian." Pötzl seems to mean something like the right side of a line across the middle of the picture that the eye will tend to fall on.—*Tr.*]

[16] [The evidence is apparently the records and the drawing.—*Tr.*]

For the sake of the connections which we are pursuing here, however, we will refrain from [the discussion of] such specific, controversial relationships. Our considerations will be confined to what anybody can recognize on the slide as unquestionably corresponding to parts of the dream. Another such correspondence may be found in the hill which, to the observer, rises long and high above the riverbank. If the slide is presented continuously and inspected at leisure, a slight upward shift will take the gaze from the shrubbery to the hill. Later in the dream the subject was on this hill. This interval in the succession by which the dream replaced a simultaneous overview does not explicitly contain any dream movement. But in the meanwhile, as it were, a new group of images, in the continuation of the right half of the horizontal meridian toward the periphery, underwent a delayed development in the dream: the house with the attic but no roof seen in the dream is geometrically similar to the house which lies far to the right on the riverbank in the slide. The house appears to be far away, as it is in the picture. Again, a directed dream movement of the subject corresponds to the direction of this delayed development toward the right periphery in a virtual field of vision.

Simultaneously, it becomes clear that the appearance of the house in both conscious perception and in the dream does not constitute an exception to the relationship of systematic exclusion between what is perceived and what is dreamed, since the two houses correspond to different visual groups in the slide which are sharply separated in the course of development.

After all these relationships have been established, the subject is shown the slide. She immediately recognizes that the whole horizontal strip corresponds to her description. The house that appeared in the dream fell roughly around the 60° parallel during the exposure. The shrubbery, the thicket of brambles, the appearance of the forest path, the hill, and the house all appear to the subject to be identical with the corresponding elements of the dream. [But] the entire lower right part of the picture and the blue river seem totally strange to her. She comments: "The alarm clock woke me up; I was annoyed, and wanted to go on dreaming."

As was to be expected from the preliminary experiments, the house which the subject believed she saw at the time of the exposure corresponds to the part of the ship which is between the two triangular sails. The image of this house in indirect vision can easily be constructed and it is obvious that not even in a prolonged ex-

> posure, to say nothing of an exposure of 1/100 second, can any other details be seen at the same time.
>
> With this it is also established that the horizontal strip which developed after a delay in the dream borders on the part of the slide which was seen most clearly. It was not unimportant for the experiment that this strip of the picture, with the direction of movement it contains, fell just on the right half of the horizontal meridian. Here, owing to the fixation-reflex, conditions are particularly favorable, in right-handed people, for a transformation of points looked at into points from which one looks; this was to be expected for me also. This is a phenomenon of imagery which arises when a visual-motor act is inhibited.
>
> The fact that it was just this part [of the picture] which underwent delayed development was probably not due to the subject's individual or analytic constellations alone, but also to the optical conditions of the exposure. All these factors interact, of course: for instance, this dream has a personal note [which is] identical with that of the dream in Experiment III.[17]

This experiment too faithfully yields the relationships already familiar from the earlier experiments. In addition, it establishes relationships to normal indirect vision which are crucial for our problem. It shows that the same evolutionary tendency which leads to visual development of a delayed and fragmented kind, and which in Obszut manifested itself in a pseudofovea brought about by a central process, exists, in principle, in normal people too. The identity of the two processes, in respect to all the points discussed here, hardly needs comment.

It should be remembered that the conditions of the experiment involved not only indirect vision, but minimum exposure time, which I retained to make sure that I was dealing with unconsciously perceived material. The temporal factor is absent in Obszut's case and in conditions of indirect vision in everyday life, but this fact is not an obstacle in the way of my comparison of them with the experiment: if even after such brief stimulation there is a delayed development of forms from the peripheral regions of the visual field, then we may assume that in ordinary indirect vision too such delayed development can and frequently does occur. In any case, it is to be assumed that certain processes must be at work therein analogous to the dream-promoting role of the fluctuations in depth of sleep.

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[17] [The subject was the same in these two experiments.—*Tr.*]

In fact, the analyses I have made in the last two years of the day residues of many dreams show that the conditions of indirect vision, as well as the lowering or distraction of attention at certain moments, are of particular importance for the delayed development of visual impressions in dreams. The above experiment illustrates these conditions, which I have long been familiar with, and eliminates sources of error. It thereby also illustrates the fact that the transformations of direct and indirect vision into one another correspond to a physiological process which accompanies —or at least may accompany—every visual act.

III. Illustrations of the Experiments. Results of the Procedure of Representation

The geometric-visual faithfulness of many of the correspondences between dream image and slide which I established in the experiments discussed above, and in almost all the others as well, seemed to make it comparatively easy to illustrate the experiments in a purely photographic way. This procedure also seemed to promise a further gauge of the faithfulness of visual dream reactions to the original slide. These photographic representations allow, in fact, a much more far-reaching analysis and interpretation of the experiments than what has been given above on the basis of mere description. Therefore I will not limit myself to a brief explanation of the illustrations, but, rather, feel obliged in this discussion to subject each experiment to another detailed analysis. It is conceivable that the commentary in the preceding section could have been combined with the analysis to follow here. However, I prefer the form of presentation I have chosen because I believe that not only should the results of an experimental study be communicated and discussed, but that the manner in which the results were obtained should remain visible.

This discussion of the illustrations will show that the photographic representation of the dream images has a claim to be regarded as faithful. We may find, in fact, that this faithfulness does not fall far short of that which is expected of a photograph of a section of the brain. Moreover, it will be possible to show that the individual steps in the preparation of the photographs are themselves fair analogues of some of the discernible characteristics of the sensoriphysiological and psychological processes involved. The fact that this analogy is completely new will not deter me from following it up in detail. It should not surprise us that the analogy extends even to details. Photographic methods have played an important part in the morphological representation of neurofibrils too. The very modifications that had to be made in these methods have a physicochemical significance which has recently been given the increased attention it deserves (Liesegang, 1911; see also Liesegang, 1910).

A modification of the photographic process for obtaining positives shows quite clearly that the neurofibrils are morphological constants. If one wishes to pursue variables which are far removed from morphology, it does not seem unreasonable to hope that psychological givens may be indirectly captured by a photographic method, but, of course, only when these givens have been brought into the experiment to begin with. The analogy referred to here appears the less questionable since it cannot lead us astray into the kind of reverse causal inferences to which the anatomical approach is still unduly inclined, both overtly and covertly. In essence, what we find is that two completely separate aspects of a natural process can be represented by quite analogous methods. This strengthens the impression that one of these aspects is just an image and an analogue of the other, and that the two are related to one another as an analytic proposition is to a geometric form.

The obvious relationships between the modified processes of apperception which appeared in the experiments and the details of the photographic procedure justify our giving, before the analysis of the experiments in terms of the pictures, a brief description of the techniques used, although they were only the most common photographic procedures.

The illustrations were prepared according to my instructions by the Viennese photographer Karl Grail, to whom I am deeply indebted for his care, subtle understanding, and extraordinary patience. The principle adhered to was the use of photographic techniques only, that is to say, only underexposures, occasional overexposures, and partial lighting to alter the background. Retouching was used sparingly, and only in order to eliminate, blur, or accentuate contours present on the slides, not to create contours not present in the originals. The only deviation from this principle in the experiments represented here (Experiment II, Figure 7a, the lower outline of the side of the black ship) will be explicitly noted and explained. In addition, we always carefully checked whether or not a contour accentuated by retouching was actually perceived more sharply when the slide was projected.[1] We can vouch for the geometric-visual faithfulness of the illustrations to the corresponding parts of the slide.

A brief survey of the illustrations of these four experiments will show the details of the photographic representations:

Experiment I

Figure 1 is a simple photographic copy of the slide.

Figure 2. The part of the slide which is not shown has been covered by the usual means of retouching negatives, that is, by painting the negative with a covering color (red).

Figure 3. Like Figure 2. The gray background was brought about by overexposure in printing the positive.

Figure 4 is a copy of one of the subject's drawings.

Experiment II

Figure 5 is an ordinary reproduction of the slide.

Figure 6. The missing part was covered up on the negative. The general vagueness of form was achieved by unsharp focusing.

Figure 7a. The lower part of the original picture was covered up on the negative. The upper part (the sky) was overexposed in printing the positive. The dark shape representing the ship was produced by combining two exposures. In the first exposure, the lower half of the negative was covered up, leaving the upper part untouched so that it appeared very dark in the copy. In the second exposure, a second negative was superimposed on the upper part of the first negative. The upper half of the superimposed negative was evenly covered with red, except for the area which corresponds to the ship.

Figure 7b is a reproduction of one of the subject's drawings.

Figure 8a was produced by the same means as Figures 2 and 3.

Figure 8b is a reproduction of a drawing. For the sake of comparison, the drawings reproduced here and later have been adjusted, by enlargement or reduction, to the size of the corresponding parts of the slides. This is apparent in the present illustration. The change of dimensions may be considered completely insignificant, since the subjects' drawings, like most primitive drawings, obviously have no definite relationship to the size of the visual groups in the slide.

Figures 9, 10, and 11 are like Figure 8a.

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[1] [Apparently, accentuating a contour by retouching was considered justified only if projection also accentuated it.—*Tr.*]

Experiment III

Figure 12 reproduces the slide.

Figure 13. The light area in the middle was brought about in the usual way, by retouching that part of the negative. The indistinctness was achieved during the process of printing, by not pressing the photographic paper against the negative.

Figure 14. The area which is not represented was retouched on the negative. The gray background was achieved by a partial re-exposure of the positive.

Figure 15a was prepared like Figure 14, except that all of the positive was re-exposed.

Figure 15b is the subject's drawing.

Experiment IV

Figure 16 reproduces the slide.

Figure 17a was copied from an enlarged negative with appropriate retouching.

Figure 18 is like Figure 17a. The meadowlike effect of the ground was obtained by overexposure of the positive, and light covering with chalk.

Figure 19a is like Figure 17a.

The remaining figures reproduce drawings by the subject.

These explanations show the techniques by which the illustrations were obtained. What follows is a detailed explanation of their contents and an analysis of each experiment.

First Experiment

Figure 1 shows the slide, tachistoscopically presented to the subject for $\frac{1}{100}$ second in the position in which it is shown here [upside down].

Figure 2 shows what the subject apperceived of the tachistoscopic exposure: "Writing. Like hieroglyphics." A light background. "Like something written in the desert."

We can see the transposed strokes which the subject noted. The figure shows, besides the transposed L's (┘), the presence of correct L's, which may have "set"[2] the subject. As for a past situation whose residue contributed [to this apperception], it was established that about a month before the experiment I had spoken, in the presence of the subject, about the transpositions in visual perceptions of tachistoscopic exposures, and about the errors of memory involving transpositions in normal people. At that time I mentioned, and illustrated, how I had once unknowingly made a drawing which transposed an [illuminated] initial of one of Tony Johannot's illus-

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[2] [*Konstellierend mitgewirkt.—Tr.*]

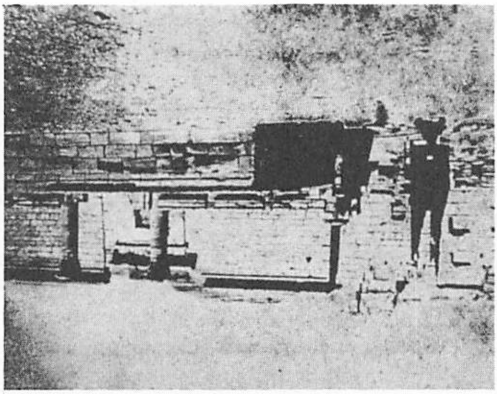

Fig. 1

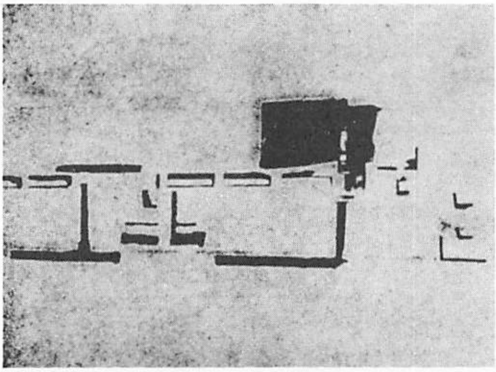

Fig. 2

trations[3] of Don Quixote. The initial in question represents the knight as he plunges head first from a cliff; his shadow forms an L. The cliff appeared on the right leaning against the printed part of the page, and the L-shaped shadow of the knight was accordingly drawn as ⅃, leading me to a parapraxis. I often use this example to explain transpositions[4] which occur through condensation. The subject was interested in this reaction of mine.

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[3] For instance, in the well-known German edition with an introduction by Heinrich Heine (Stuttgart: Verlag der Klassiker, Vol. I, p. 162, 1837).

[4] [*Verlagerung,* a term which for Pötzl also has the connotation of Freudian "displacement."—*Tr.*]

The "large letter, wide at the top, and then narrowing down" can also be seen.

Figure 3 shows the part of the dream image which was unmistakably derived from the slide. The area of the "large, wide letter" is now empty, as its outline indicates. Figure 4 makes this clear. It is a photograph, enlarged one and a half times, of the drawing which the subject made, at my request, of the situation "at the garden wall," before he looked at the slide. It is particularly noteworthy that not only are the positions analogous, but, as can easily be seen, the lines of the female dream figure conform to those of the shadow figure. Such conformity would be inexplicable without assuming a direct unconscious influence of the shadow figure.

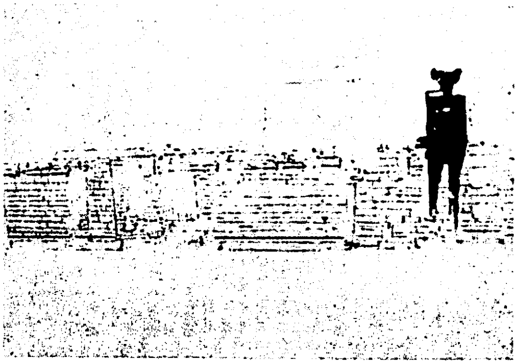

Fig. 3

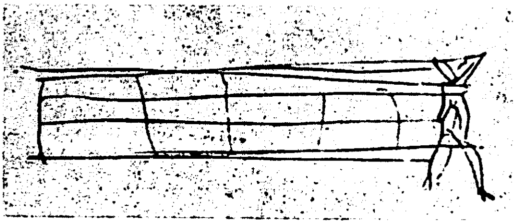

Fig. 4

It should be noted that the difference between the position of the sketched figure in relation to the wall and the position of the figure in the tachistoscopic residues [developed in the dream (Fig. 3)] is immediately explained if we take into consideration a condensation of the positions of both the walls in the slide and average their positions relative to the shadow figure. The subject's description of the dream image and the pantomime with which he accompanied it, however, correspond to the position shown in Figure 3.

If the foregoing is correct, then even the remaining part of the slide, the upper section of wall on the left, was present in the delayed development. Incidentally, this otherwise omitted part of the slide could well have been included in the afterthought "cigarette advertisement." But the subject had nothing definite to say about this, except that he "had seen it somewhere" and believed that the Sphinx was in the foreground of it. The advertisement in question is therefore probably for "Samum" cigarette paper.

I am familiar with the garden which appeared in the subject's dream; there is a rather long wall in it, which may well provide a geometric-visual correspondence with the wall in the slide and in the dream.[5]

A few weeks before the experiment I had seen X, who appeared in the dream, passing the subject on his left, but the subject, being slightly near-sighted, did not notice him, a fact which I established by questioning the subject. X and this garden wall were, at that time, to the left in the subject's indirect vision.

The dream recapitulates this scene, with a turn of phrase characteristic of X, which X, of course, did not use on that occasion. But the dream includes the shadow figure and covers it with a third person,[6] who was not present at this encounter in the garden, but does belong to the environment common to the subject and X.

Thus the constellation in this experiment showed those correspondences between one preconscious material and another, and between material developed in waking consciousness and material developed in delayed association, which have been considered in the previous section.

In this experiment, the real subject of the slide reverberates strongly throughout everything that developed in waking consciousness, while what appeared in the dream is entirely unrelated to it. This happens frequently, but not always. For instance, in Experiment XII[7] the situation is just reversed. Only the relationship of mutual exclusion [between the contents of waking consciousness and the dream], the separation of the two realms, was constant in all the experiments.

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[5] When questioned later, the subject knew nothing about this either.

[6] [This refers to Y.—*Tr.*]

Second Experiment

Figure 5 represents the slide.

Figure 6 is an attempt to reconstruct, from the subject's description, what he saw in the tachistoscopic exposure: "Just black and white . . . shadows, long stripes." As an afterthought: "Like trees." This description corresponds to the picture, whose "futuristic" character is worth noting. Its partitioning by the horizontal line may

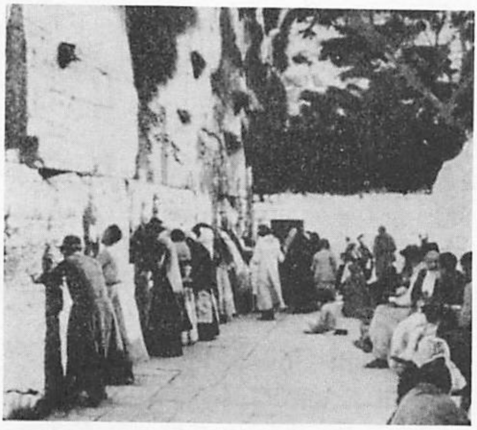

Fig. 5

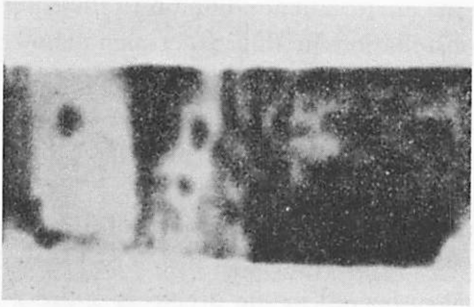

Fig. 6

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[7] [An unreported experiment.—*Tr.*]

seem arbitrary, but this follows of necessity, as the relation [of this picture] to the other illustrations of the series shows.

Figure 7a represents the first phase of the dream image: "At first the sea was rather high. The water, the waves, shimmering white. The ship was completely black and only the front part, prow and smokestacks, was visible . . . they were vertical." The contours of the door in Figure 5 can be recognized in the picture. The outline of the waves represented here comes about when the human figures are cut out of the picture. "But there weren't any people on it." This too at first seems arbitrary, and, indeed, there is an arbitrariness in cutting off the dark outline of the door at the bottom, to assimilate it to the subject's drawing (Fig. 7b). Figure 10, however, will show that this construction is not merely an artificial equating.

Figure 7b is the subject's drawing of this phase of the dream. It is striking that, for instance, the subject indicates one chimney on the left and two on the right. Similar formations appear in the corresponding parts of the slide.

Figure 8a represents the "embedded picture" contained in Figure 1,[7a] which presumably corresponds to the second phase of the dream: "Later on it changed. The ship was much larger . . . seen from the side . . . entirely white . . . no people on it." "Entirely white" cannot be reproduced here, of course. It corresponds to the blinding white glare of the walls when the slide is projected with artificial light. The same thing also applies to the "sunny background" seen by the subject in the first experiment.

Figure 8b is the subject's sketch of this phase of the dream. It should be noted that there are, on both ends of the hull, two superfluous outlines, not usually found in such primitive drawings, which can easily be related to the ship's pointed ends[8] in the embedded picture. The similarity of the position seems obvious. The outline of the waves is convex both in the embedded picture and in the drawing.

Figure 9 shows the third phase of the dream image, where the correspondence of dream and slide is obvious to anyone. "Then this picture changed. There were a great many people on it, very tiny, like dots; in vivid motion. I saw the arms . . . moving . . . as if they were waving something . . . shawls or something like that. The arms were too big for the figures." Later, after the subject and I had looked at the slide together: "Even the position of the arms is right. . . . They were all holding their arms forward, like the people in the picture . . ."

"That is just the way they are on the ship. They are all leaning against the railing."

[7a] [This should obviously read 5.—*Tr.*]

[8] ["Pointed ends" translates *Schiffsschnäbel.*—*Tr.*]

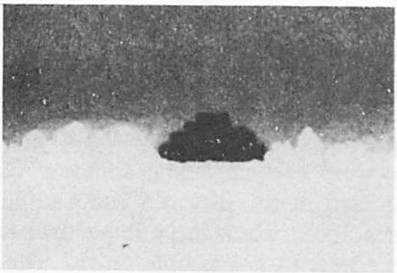

Fig. 7a

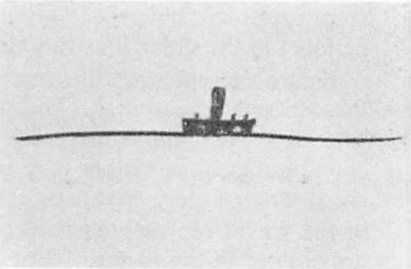

Fig. 7b

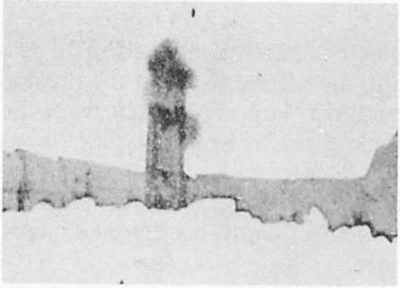

Fig. 8a

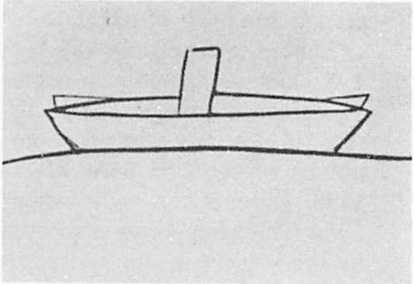

Fig. 8b

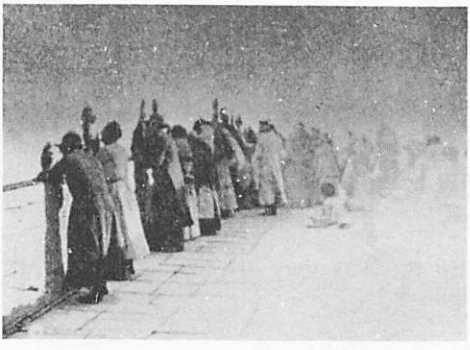

Fig. 9

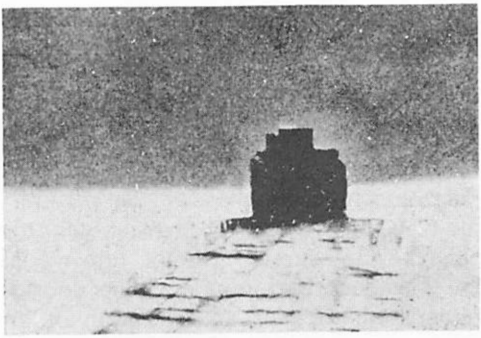

Fig. 10

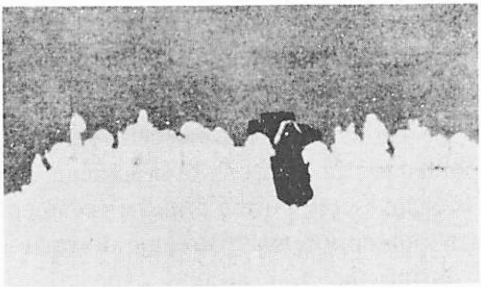

Fig. 11

It is clear that the railing stands out quite naturally if, but only if, we eliminate all those parts of the picture which lie above the outline of the wave in Figure 8 and have already been visually developed in the dream, and replace them by something comparable to the background of a [portrait] photograph. This justifies both the outline of the wave in Figure 8, and the way in which the original picture is dissected in Figures 6, 7, and 8. Let me point out again that this complete mutual exclusion between the parts developed in the dream and those developed in the waking state appears with absolute regularity, not only in all the dream experiments, but also in the numerous experiments with cases of hemianopsia and hallucinosis.

The shadows on the wall faithfully represent the unnaturally enlarged arms. The rest of the ship's now open deck (see Fig. 8b) and the people on it fade into the whiteness, which corresponds to the sea with its "shimmering white" waves. This glistening white sea more or less corresponded to the same part of the picture in the earlier phases of the dream.

Figure 10 is an attempt to represent all the elements which appeared one after another in this part of the picture in the apperception of the tachistoscopic exposure and in various phases of the dream, in such a way as to show them in the process of differentiating out of the whole complex of the picture. The horizontal boundary line of what was seen during the tachistoscopic exposure, chosen in Figure 6, appears here as the upper edge of a gleaming white surface. The dark background at the door is represented as already differentiated; there is an indication of how the incipient contours of the groups of people tend to give a wavy motion to this white glistening sea. In all these experiments, perceived movements were always the first harbingers as well as the last reverberations of the delayed hallucinatory development of a visual group. The last phase of the development of this dream is anticipated here, since what will later become the deck of the ship is already taking shape emerging from the waves, while the contours of the stormy sea already assign the positions they occupy in the original picture to the people who will later appear on the deck.

It must now be shown that the nascent state represented here closely corresponds to the sensoriphysiological conditions of the experiment. It is clear (see Figure 6 and the comment which applies to it) that form perception was directed toward the upper half of the picture during the $1/100$ second exposure. Thus the lower parts of the picture were peripheral, at least as far as attention was concerned. The boundary between the lower and upper parts of the picture is a glistening white continuum, formed by the two walls on the right[9] and in the background of the picture. The boundary line is the very horizontal line which is represented here. The fact that in the embedded picture of the ship (Fig. 8) this line appears to be a straight line across the plane of the picture corresponds to that substitution of two-dimensional for three-dimensional perception which is common in normal subjects' perceptions of tachistoscopic exposures, as it also is, according to my observations, in the parapraxes of patients with spatial-visual agnosia, and in the analytically investigated common visual day residues in dreams.

The formation of a glistening white surface as the first preconscious impression of the lower part of the picture is supported and facilitated by the wide expanse of paved courtyard which gives such an impression in projection with artificial light. We must also consider the irradiation to which the glistening white of relatively large surfaces is particularly disposed in tachistoscopic exposures, and to which this subject is particularly susceptible because of the asthenopia that resulted from his occipital shot wound. This is how the white surface shown in Figure 10 came about. But only the later phases of the dream show that it already contains the nuclei of all the forms of this part of the picture.

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[9] [This point is unclear. It would seem that it should read "left."—*Tr.*]

The nuclei of these forms reveal themselves first in the stormy movement of the glistening white sea. This has numerous sensoriphysiological parallels. In the third phase of regeneration from total blindness following an occipital shot injury, all patients report—after the dark continuum and after the uniform gray one, when the differentiation of Hering's two valences of light perception[10] begins—movements, rising waves, and a heaving in the cloudy masses, which they see in part as gray but in part as unpleasantly, blindingly bright. In addition, later there appears the well-known black and white flicker, as in the cinema, which often continues long after the restitution process is completed. From this moving cloudy mass there also emerge the first black and shadowlike outlines of forms, though they appear for only a few seconds and disappear again, mostly, however, without apparent movement.[11] There are sometimes (as in the case of Hincica, which I have described elsewhere) cloudlike or spiraling positive scotomata, which reabsorb the black and shadowy forms of larger objects, such as trees, human figures, etc., that have already emerged. Such patients (Hincica) sometimes report afterwards that this spiraling cloud, the positive scotoma, progressively contracted and finally surrounded the fixation point (like a visual field in a state of tiredness which has become positive), but that it then suddenly exploded, so that the form which it has just concealed appeared again. The term "explosion" is entrenched in normal subjects' descriptions of their experiences at the tachistoscope, which are obviously analogous to the experience just described. Finally, I should like to point out that everyone who is in the habit of paying attention to the visual residues of his own dreams is familiar with the dark, dusky fog, as well as with the brightly glistening background which sometimes corresponds to the lighting which prevailed during sleep and fills the dimensionless space in which the dream images arise.

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[10] [For the Hering theory to which this and subsequent passages presumably refer, see Boring (1942, pp. 208-209). It is doubtful that what Pötzl calls "valences" refers to what Hering called "valences": he probably means the two directions (assimilation and dissimilation) of the chemical changes that Hering's visual substances are capable of. Similarly, the relation of Pötzl's use of the terms "A and D perceptions" and "A and D phases" to Hering's assimilation and dissimilation processes is not pellucid.—*Tr.*]

[11] [This sentence and the next one have been put in reverse order.—*Tr.*]

It is in keeping with all this that here the black door emerges as the first solid shape in the transformation of motion into form, and that the people who emerge from the wavy motion first appear as "very small" swarming dots. This "swarming" recalls the flicker in cerebral asthenopia, the scintillating scotoma in migraine, and the background of the hallucinations in alcoholic delirium. Here there is a connection between the process and pictorial representation of the experiment and "the chaos of light in the dark visual field" to which Wundt attributes, in my view correctly, a significant role in the formation of dream images.

Thus we see that in all these illustrations of the experiment only one contour was chosen arbitrarily: the wavy, approximately horizontal line (Fig. 7a) which separates the black ship from the sea. This was the only line added by the illustrator in deliberate imitation of the drawing reproduced in Figure 7b, as is clear from a comparison of this part of the figure with the corresponding parts in Figures 5 and 10, since the coat on the human figure in the middle (Fig. 10) is black, even on the colored slide.

But this deliberate imitation is in error, as any observer who knows how to discover an embedded picture can quickly show. Let us now imagine that everything that is not black in the projection is excluded from the black form of the door and its vicinity. What we get then is the correct picture of the black ship in the dream: the front part of the ship is visible, with the prow cleaving the waves. This then corrects Figure 7a (in Fig. 11): "Only the front part, prow and smokestacks, was visible . . . they were vertical." The ship's prow cleaves the white sea and lets the deck arise from it (Fig. 10). We have now considered all the forms in this pictorial representation of the experiment. The sensoriphysiological derivation of the representation convinces me of the accuracy of the illustrations, and serves as an example of the method used to achieve this accuracy. Now it also becomes clear why neither the subject nor I recognized all the visual correspondences between slide and dream until the final inspections of the material.

Inspecting Figures 7b and 8b again, we notice that the subject's drawing in Figure 7b represents *both* ships described in the first two phases of the dream. Figure 8b already contains something of the third phase of the dream, since here the deck is open. In the drawings, condensations tie together what would otherwise be held together by the overview or by spatial or temporal movements of the dream images.

The subject's reaction to these reproductions of his impressions, drawings, and dream images is of interest from the point of view of sensory physiology. The reproductions were shown to him relatively late, long after they had been completed (June 10, 1917). Just before this, the subject was asked for the first time since the experiment whether he still remembered it and the dream.

> The subject answers affirmatively: "I saw a picture. I remember that a lot of people were standing by a wall, but I can't remember just how they were dressed."
>
> What he still knows about the dream: "There was a ship; but I no longer remember whether it was black or white."
>
> Now he is shown the pictures. He immediately recognizes the slide. Then his glance goes to Figure 8a, which is supposed to represent the white ship of the dream. He accepts it spontaneously and unconditionally: "That's just how it was. Even the ship's pointed ends[12] are here." He points to the earlier indicated parts of his drawing which are reminiscent of a ship's pointed ends. "That's why I drew it this way."
>
> The ship's pointed ends in the dream and in the drawing had never been discussed with the subject before, since this correspondence had not struck me until much later, during the preparation of the photographic illustrations of the experiment. The drawing itself was [first] covered so that the subject could [later] use it for identification.[13]
>
> The subject is now asked to find the embedded picture of the ship in the slide. After a brief search he moves his finger over the corresponding horizontal line. But he does not find the smokestack, and points to the left of it, just between the two groups in the slide

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[12] [See footnote 8 above.]

[13] [Apparently the drawings in Figures 7b and 8b were not shown to the subject at the same time as Figures 7a, 8a, 9, etc. "Use it for identification" seems to mean "use it as a check on his memory."—*Tr.*]

which are like embedded pictures and which can easily be taken for smokestacks and smoke by a person capable of illusions. Of the two groups of forms, the one to the right was chosen for the illustration. It is an open question whether or not the one on the left may be the correct one, or whether we are dealing with a condensation of the two groups.

The subject is asked if he has seen this embedded picture before; he answers in the affirmative: "You showed it to me at the time, doctor." This was not the case, for the reason already mentioned. What he was shown at the time was the black form of the door. This is the phenomenon which Freud (1914) observed in psychoanalytic work and described as *déjà raconté.* The subject corrects himself, however: "Oh no, this is what you showed me, doctor," and points to Figure 9, which he now definitely identifies with the dream. "This is right too: there were such indistinct people in the background. That's why I drew the deck this way." (The subject pantomimes the square shape of the deck) "The arms too . . ." he adds.

At this point the questioning of the subject began. First his attention was called to Figure 7a. He finds that the white sea is correctly represented; he also accepts the black ship, likewise the tone of the background. It is obvious that he is guided by a comparison with his own drawing, which is in plain sight.

Now his attention is called to Figure 11, and he is asked whether or not it is a better representation of the ship in his dream. But he decides in favor of Figure 7a: "It did not go down that far." It is pointed out to the subject that, according to the record, he said at the time that the ship cut the waves vertically and that a prow ("and smokestacks") were visible. He now compares the two ships and says: "Yes, there was something at the bottom, something like this (the prow in Fig. 11) which is missing here (in Fig. 7a); but it did not reach down this far." After a pause he adds, "But the ship was in motion, and the motion is right in this one" (he points to Fig. 11). Asked once again which of the two pictures is more accurate, the subject is unable to decide: "It was something between the two."

He looks again at Figure 11: "What is especially right here is that the waves are edged in black; because they *were* black-edged." It is possible, of course, that this is a retroactive illusion; but it should be noted that the outlines of the human figures in the slide, which were used in this representation as the outline of the waves, are actually edged in black. Apparently the subject did not notice this detail of the correspondence in the original picture. Therefore his statement may be considered as additional evidence for the derivation of the outline of the waves from the outlines of the human figures in the picture.

> Figure 10, which is meant to represent the differentiation of the dream images, is entirely strange to the subject and strikes no familiar chord. This is in agreement with the purpose of the picture, which is to represent the mechanism of the process, not the manifest image.
>
> Questioned about Figure 6, the illustration of the impression given by the tachistoscopic exposure, the subject says: "I would rather imagine it was like that" (as the picture shows it). Here the interview ended.

Here I am prepared for an objection which, though quite obvious, is without foundation. Given the well-known fleeting character of dream images, the haziness of the recollections of dreams and their tendency to be forgotten, is it possible that late recollections of a dream, which has not been refreshed in the interval, could still bring to light so many minute details of the dream images, that a discussion of the validity of the illustrations would still have an objective meaning?

In answer, we must point out that a dream which has achieved the form of a memory by having been recalled immediately upon awakening, and which has also been discussed and recorded, is, in general, no longer fleeting; to some extent it has been fixed. Anybody who has treated his own dreams in this way can confirm from his own experience that dreams which undergo such subsequent consolidation can usually be retold quite faithfully even after long intervals. Their retelling usually leads to associations which may occasionally add a new delayed fragment even to the analysis of the dream. Dreams which a person likes to tell and does tell frequently, especially in intimate conversation and attributing importance to them, often belong in this category, and their visual residues return rather faithfully every time the dream is told, while the recounting of the happenings of the dream assumes an increasingly novelistic form.

The subject's dream was consolidated and fixed in this way. His report of the experiment and the dream at the beginning of the interview is what came [to him] without prompting, but it can of course be considerably enriched by external prompting, such as a partial reconstruction of the situation of the experiment or of the dream. The illustrations apparently provide effective prompting. Quite as happens in the analysis of a recent dream, rather rich associations arise, which bring delayed, forgotten visual details, and at the same time stay close to whatever is the visually effective prompting.

From experience with presbyophrenics it is quite well known that the reconstruction of a visual situation usually prompts the restitution of a memory, even in very severe disturbances of immediate memory.[14] This is particularly striking in cases of Pick's disease with focal symptoms resulting from a localized atrophy of the brain. I demonstrated this reaction in, for instance, a case of visual agnosia of this type which I studied in detail both clinically and anatomically (Pötzl, 1911). This patient, whose color vision was preserved, almost never recognized a form of any kind. He often reacted to a picture which he had seen the previous day with the words "I have seen it before." Patients with similar but milder disorders will frequently produce, on prompting by something they have seen previously, visual details which they had forgotten but which belatedly occur to them. They react very much as our subject does to his visual dream residues when he is prompted by the illustrations.

The subject's behavior could therefore be regarded as evidence that the pictures are good representations of the situation in the dream, rather in the way in which, in Freudian analysis, apparently very heterogeneous associations to dream fragments often betray their close relation to the latent dream content. But we can forego this argument here, since in evaluating the results in sensoriphysiological terms I wish to use only objective findings which are independent of the cooperation or resistance of the subject, and to exclude the possibility of retroactive illusions.

Thus in these discussions of the subject's reaction to the pictures I am far more concerned with the recognizable sensoriphysiological type of each of the subject's reactions than with his assent to the representations of the dream reactions. Some of the subject's comments are indeed useful in the former respect and contribute to the clarification of the relationship between illustration and reaction. For instance, it is noteworthy that it is just Figure 8a whose identity with the dream is the first to strike the subject spontaneously; of all the illustrations, this one, showing the contours which are contained in the slide in the form of an embedded picture, is the most questionable. It is also of interest that the subject does not discover all of the embedded picture in it, although owing to an illusion of memory he believes that he has seen it once before.

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[14] ["Immediate memory" translates *Merkfähigheit,* a term which is commonly used in contrast to *Erinnerungsfähigkeit* (retention). Another valid translation of the word is "attention."—*Tr.*]

In contrast, neither of the two pictures of the black ship quite satisfies the subject, and we can infer from his remarks the sensoriphysiological reason for this dissatisfaction—a kind of dissatisfaction which is frequent in these experiments. In Figure 11, the emerging prow is well represented, but the hull of the ship should not reach so far into the waves. On the other hand, the motion of the ship is, according to the subject, well represented by the picture. We have encountered the interchangeability of form and motion so often in these experiments that such an interpretation seems plausible here too. In the differentiation of the black form out of the mass in Figure 10—a process which is analogous to the appearance of the first shapes out of a cloudy mass in the regeneration from blindness caused by an occipital shot wound—a part of the form changed into a mental quality of motion, just as in experimentally elicited hallucinations the content of the last hallucination is merely a perception of motion, in keeping with the fact that the perception of motion, of change itself, is the phylogenetically and ontogenetically lowest level of visual perception (Exner, 1875).

Finally, we must note his remark about the black-edged waves of the sea in his dream. It seems that the sea actually arose from the dark gray surface as a boundary line, just as it is represented in the pictures. The dark heads of the people appear as crests of waves. This further confirms the precision of the representation of the background, and at the same time, in keeping with our previous discussion, points to its sensoriphysiological origin, which we can now review using simple, familiar examples. A fleeting illumination at an exposure of $1/100$ second will result in the familiar phase of oscillation, which consists of repeated, periodic, alternating perceptions of light and dark (see, for instance, Stigler, 1910, pp. 384, 385). We must apparently assume that this process continues into the phase of rising visual dream developments, probably especially if it was excluded from waking conscious perception. It provides the matrix from which the dream images differentiate. For the upper half of the picture this matrix is a dark continuum, for the lower half a light one. In the instant of exposure what appeared were black and white patches for the upper half and, probably, "vision nul" for the lower half. This agrees with the well-known regularity of the alternating sequence of afterimages.

This matrix can thus manifest all the points of alternation and all the condensations of Hering's D and A perceptions, determined by two antagonistic central processes, as they alternate and interact in the first phase of the regeneration of visual agnosia.

The relationship of Hering's Phase A to the visual-motor transformations which appear in these experiments, in investigations of cerebral metamorphopsia, and in the visual residues of the relative scotoma, etc., and to the perception of movement, contrast, and form quality, seems to me rather obvious, as does the relationship of Hering's Phase D to the irradiation of brightness. Thus the subject's remark, quoted above, is sufficiently explained if we assume that at the time of the dream development in question, the surging gray matrix of one of the points of alternation in the oscillating delayed development in the so-called entoptic light of the retina (Wundt)[15] predominated accidentally, that is to say, for reasons that cannot be determined. This dominance *may*, however, have been related to the fact that during the experiment the subject saw a great deal of white and black in the upper part of the picture. The fact that the black outline of the door is the first to differentiate from the surging gray is analogous to the sensations of visual agnosics, who at first see only shadowy black shapes emerging from and disappearing into the pulsating gray. A further point of alternation makes the brightness which has differentiated appear bordered by finer dark contours, etc.

These details support the assumption that the background of the dream images brings back those phases in which, in our example, the perception of light penetrates a visual-motor block. Such a block is present in dreams. It is obvious that the basic conditions are identical, and plausible that the psychological effects are too. Since a comparison of these phases with the evolution of vision in the vertebrates (Exner, 1875; Hess, 1913, p. 127ff.) shows that to a certain extent they correspond with phylogenesis, some empirical support is given to Lafcadio Hearn's surmise that phylogenetic experiences arise in dreams in the anxiety connected with them and in the visions of ghosts which occur in them. In any case, the conditions of regeneration in generalized cortical disturbances of vision on the whole follow the pattern of that in visual agnosia. Patients with visual agnosia react in continuous and in direct perception in the way that normal subjects react to tachistoscopic exposures and to exposures in indirect vision. Cortical blindness is, from this point of view, an agnosia for Hering's two qualities of vision, and we encounter it in certain phases of the visual dream-reaction to stimulation by tachistoscopic exposure.

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[15] The purely retinal nature of the entoptic light of the retina, the independence of this light from central processes, has no more been proved than has the purely retinal nature of afterimages. Central and peripheral processes interact in these just as they generally do in the activity of the visual apparatus. The argument about the central *or* peripheral nature of the phenomena mentioned may be idle.

Third Experiment

Figure 12 represents the slide. An x marks the part of the slide which contains the main characters of the knife dream as an embedded picture. The embedded picture can be found quite easily in this reproduction, even without a magnifying glass, by comparing it with Figure 14. Once one sees it, it acquires the obtrusiveness we are so familiar with. I and others have found that the embedded picture is no clearer in the enlarged projection of the slide with artificial light on frosted glass than it is in this reproduction. It was presented to the subject for 1/100 second and she never gave the slightest indication of having perceived it. I myself did not notice this point of correspondence until the final study of the material, six weeks after the experiment (see text). At that time we had not yet started on the illustrations.

In order to understand the dream figure's attire in the embedded picture, it should be mentioned that the subject is a nurse.

Figure 13 represents the subject's description of what she saw during the tachistoscopic exposure: "Lots of shops. Stores. Lots of people in front of them. A gap between them." The location of the gap fades into the whiteness, since, according to her report, it appeared whitish to her. The reason for this again lies in the conditions of lighting (see the relevant comments on the first two experiments). Anyone who, like me, adopts the point of view of Freudian dream analysis will weigh whether or not the word "gap"[16] contains an allusion to the content of the dream to come. If this were the case, then the content of the dream would already be present at the time of the exposure in an implicit, germinal form. This is at least a possibility; Experiment VIII of this series, which is not discussed here, showed that this actually happened in at least one case.

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[16] [See footnote 11, p. 54].

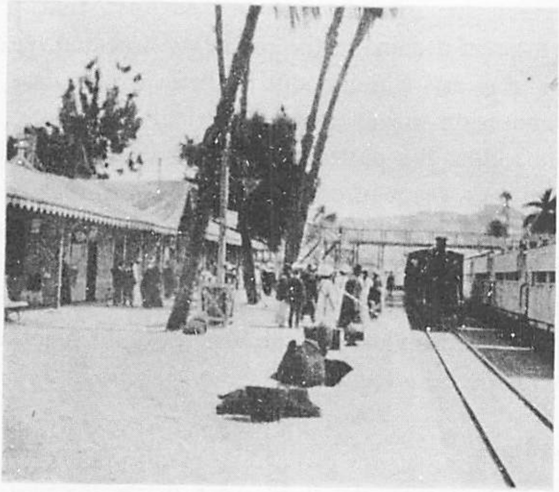

Fig. 12

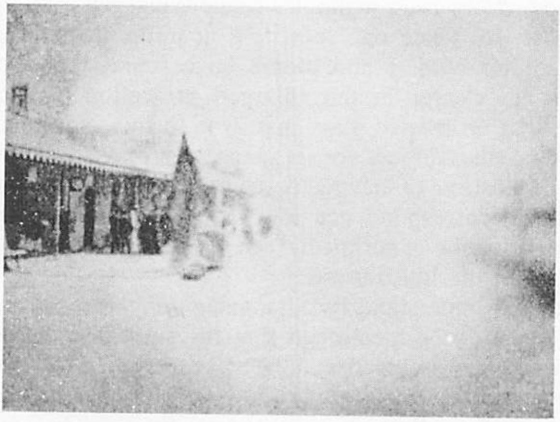

Fig. 13

Figure 14 represents the main scene of the knife dream. "A little man" (smaller than the hazy white-clad female figure in the picture); "he wants to stab me in the chest with a knife." The knife in the embedded picture seems to slide past the female figure's chest.

"But there is a brook near by . . ." The brook developed from the light surface in the vicinity of the gap. It should be borne in mind that in relation to Figure 12, Figure 14 is enlarged, and so the light surface which is to indicate the brook of the dream falls entirely within the large white spot in Figure 13. ". . . I threw it (the knife)

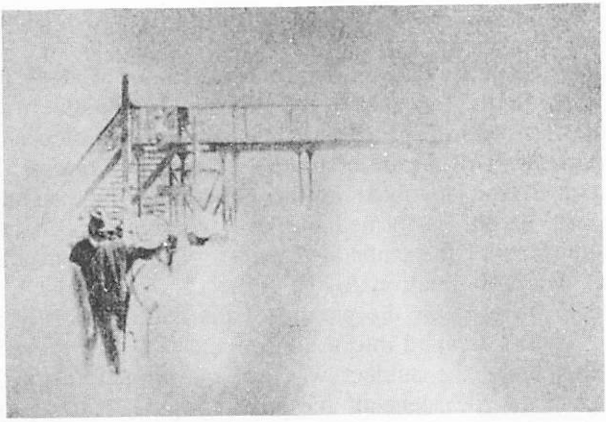

Fig. 14

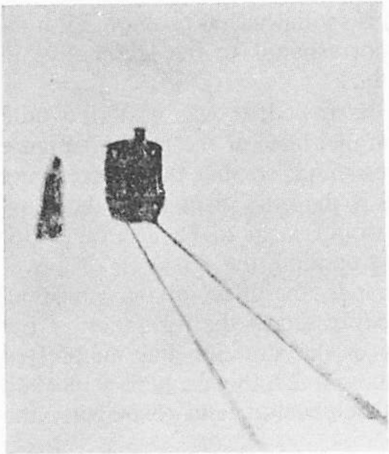

Fig. 15a

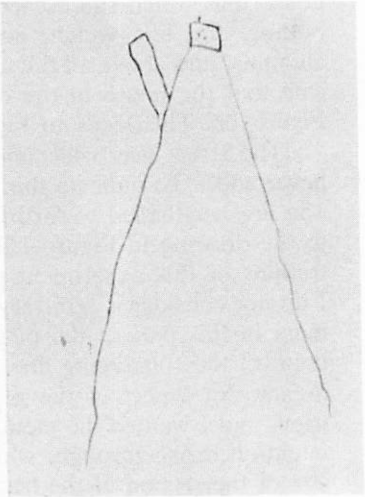

Fig. 15b

into the depths. There may have been some water below." There are two light surfaces on the slide which might correspond to the outline of the brook. Both are bordered by converging parallel lines. One of them is the edge of the platform, and the other is the surface between the tracks.

Questioned about the scene at the brook in the dream, the subject said: "Looked like a bridge . . ." and added later, "Yes, it was long and very wide . . ." Accordingly, the bridge on the slide was not changed, though it was blurred, in the representation of the dream image. It is an unquestionable geometric-visual point of correspondence.

Finally, we must discuss the enlargement itself. It is justified, to begin with, by the fact that in the experiment the slide was enlarged by projection. Moreover, the manner of representation chosen here, the enlargement of a part of Figure 12, imitates one of the mechanisms which was involved in the experimentally produced dream image: the dream performed the same enlargement. It has brought the dimensions of the embedded picture to the dimensions of living human figures in relation to the subject's own size.

Figure 15a presents the picture of the continuation of the dream story: "Then I escaped into a house," etc.

At this point the subject was not questioned further, and was asked to draw the scene of the street. Figure 15b reproduces her drawing. It is easy to see that the converging lines which represent the street are a close approximation of the converging lines of the tracks. At the end of the converging lines the subject drew the little house into which she escaped in the dream. The squareness of the outline, the line which, according to the subject, represents the chimney, and above all the analogous spatial-visual position, all indicate that the house in the dream corresponds to the locomotive in Figure 12. This leads to Figure 15a.

"The street was wide and then narrowed; it was as if it would never end." To indicate this, the parallel lines of the track in Figure 15a are lengthened toward the foreground, so that they correspond to the drawing in Figure 15b. This is the only element in the illustrations of this experiment which would seem to be arbitrary. But I do not consider it arbitrary. In my opinion, the direction of movement in this part of the picture, that is, the effect of the vanishing point of the converging lines, was expressed in the formation of the dream. An aspect of the geometry of the situation has manifested itself, and I wanted the picture to show it. Moreover, here a blocked intention broke through, which in itself would tend to magnify the size of the section of the tracks.

But in Figure 15b there is still another anomalous form. The subject "sketched it absentmindedly"[17] and when urged to explain it, showed resistance. This contour corresponds to the figure of a man in the slide, both in outline and in approximate relation to the locomotive-house and to the railroad tracks-street. The figure is right beside the white-clad woman who is being stabbed in the chest in the embedded picture and in the dream. The figure of this man (crossed by the white arrow in Figure 12) hides part of the woman's figure. If we make use of this fact for the photographic reproduction of the dream, then—making use of the regular relationship of exclusion (see the illustrations of the first two experiments)—we obtain that shadowy appearance of the female figure in the dream which is represented in Figure 14. Anyone whose dreams are strongly visual, and who remembers the forms in which he himself sometimes appears in dreams, will recognize this shadowy presence and its relation to the content of the dream.

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[17] [*Im Gedanken hingezeichnet.—Tr.*]

Accordingly, Figure 15a shows the form of this man. The analogousness of the positions is obvious. The drawing, Figure 15b, differs from Figure 15a only by one of those displacements which are so common in the aftereffects of tachistoscopic exposures. A comparison of Figure 15a and Figure 15b with Figure 12 shows that this displacement too results from a condensation of the directions of the slide's various parallels, and that all the parallels which could be involved in this condensation fall in the area of the gap.

This completes the explanation of the illustrations in sensoriphysiological terms. However, I consider the explanation one-sided and incomplete unless the subject's drawing is also considered from the psychoanalytic point of view. I will not be deterred by the fact that in the present case this aspect of the explanation is far from appealing and is unpleasantly reminiscent of drawings on the walls of public lavatories.

The subject displayed inhibition, pointing to resistance, when urged to continue her chain of associations about the meaning of the form at the end of the converging lines in her drawing. Both Scherner's (see Freud, 1900, p. 84ff., 224ff.) dream symbolism and Freudian dream analysis point to the relationship "house-genital" in this typical dream. I have deliberately refrained from completing the analysis of the dream in this direction. But the affective behavior of the subject, some of her comments which stand out in the description of the experiment, and finally the point where the resistance set in, indicate that this dream has the sexual undercurrent common to the class of dreams to which it belongs.

If we assume for a moment that this not only might be but actually is the case, then Figures 15a and 15b suggest a good deal of sexual symbolism of a very common kind. The converging lines of the drawing in Figure 15b correspond not only to the tracks, but also to the thighs spread apart as they frequently appear in those primitive, obscene drawings. The black locomotive[18] in the dream picture recalls similarly obscene drawings of the vulva, just as the other form is reminiscent of drawings of the erect penis. The relationships between gap-man-penis-knife-brook (interfemus), which, without any interpretation, are obvious in the manifest representation of the dream, easily fit into this context.

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[18] [This is one of the more conspicuous of the many inaccuracies in this article. The *dream* obviously did not contain a black locomotive.—*Tr.*]

If this is the case, then we have demonstrated, so to speak experimentally, on a trivial example, that the sexual symbolism of the dream work is represented in the illustrations. The subject knows nothing about these relationships. To her the experimental dream is just a dream which she readily talks about, and she does not see anything embarrassing in the pictures; in fact, she asked to be given them as keepsakes.

It should be mentioned here that the other subjects too confirmed with a certain perplexity that the pictures were identical, down to the smallest detail, with their memories of what they had seen and of their dream images. But, as I have mentioned before, I would not rely very strongly on this testimony. The experiments which are not reported here have shown me that spontaneous retroactive illusions about the dream frequently follow the [subject's] inspection of the pictures. These two complexes continuously exchange components by a sort of diffusion, and tend to penetrate one another. I therefore consider only those correspondences which emerged spontaneously in the subject's descriptions or drawings, before the second viewing of the slide, to be experimentally reliable.

With this reservation, and therefore mostly in the interest of completeness, it should be mentioned that this subject immediately recognized the main scene of the knife dream in Figure 14 as a faithful representation: "It was just like this. Here are even the stairs that I ran up." She also verified Figure 15a, with some emotion, without noticing her own drawing. On seeing the picture, she said, "Yes . . . the long street which seemed never-ending . . ."

None of the subjects of the experiment so far represented in the illustrations showed any familiarity with or interest in the reproductions of their own drawings. However, this is partly explained by the fact that as a rule people are not proud of such primitive drawings. Both children and adults will immediately and indignantly throw away such scribbling if someone comes along and looks over their shoulders. The subject of the first experiment, which involved spatial-visual correspondences but no symbolism, immediately verified the photographic representation of his dream, but was astonished by his own drawing: "Am I supposed to have drawn that?" In a later discussion the subject asked to see his original drawing "to arouse my memory." He believed that he had drawn Y's figure (Experiment I, Fig. 4) with only one stroke.

Apart from this explanation of the subjects' astonishment at their own drawings, it is clear that their attention was not attracted by them. On the one hand they were discharged[19] by motor action; on the other the photograph seems to render the mood of the dream, while the paltry drawing does not. In addition, these drawings contain connections and transitions (see Experiment II) which do not seem to lead to the description of the dream image and to its correspondences with the slide. In this respect they are comparable to the manifest content of the dream, even though they do contain unconscious allusions to the latently perceived forms of the slide.

I might have avoided discussing the sexual symbolism of this subject's dream except that such a course would have left undiscussed a principle which was corroborated by the later experiments in this series. The sexual symbolism seems to influence the occurrences of the dream, that is, the course of events in the dream. One possible way of looking at this is to say that symbolism to some extent selects the dream material. It might be more accurate to say that it slips into the empty shells it finds. But this still does not express the fact that sexual symbolism has, as if spontaneously, extracted from and created, and at the same time solved an embedded picture in the perceived visual material. The first impression is that it functions as a selector in dream formation in the same way that the abstracting process does in the waking state. Though it is excluded[20] from all the forms and from the meaning of the manifest dream, it nevertheless functions as a principle of apperception. In our experiment, this apperception took place in a maximum time of $\frac{1}{100}$ second.

It goes without saying that all this fits Freud's theories down to the smallest detail (Freud, 1900, Chapter 5). The embedded picture calls to mind a relationship Pfister (1913) deciphered from the folds of cloth in a painting by Leonardo da Vinci. In a way, our experiment embodies the sensory equivalent of Leonardo's motor reaction postulated by Pfister. Moreover, Pfister's conjecture is particularly supported in Leonardo's case by Leonardo's well-known comment on the rich source of fantasy images he found in gazing at the uneven surfaces of mouldering walls. Pfister's view is also supported by the fact that the embedded picture he found in the folds of cloth corresponds, in its visual form, to a childhood memory which Leonardo himself reported, and which Freud analyzed [see Freud, 1910].

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[19] ["Discharged" translates *abreagiert.* The implication here is the same as in the Freud-Breuer cathartic procedure, and in the Zeigarnik phenomenon.—*Tr.*]

[20] ["Excluded" translates *verdrängt,* the usual German term for "repression." It is not clear whether Pötzl meant "repression" here. At any rate, such a rendering would not be compatible with present usage.—*Tr.*]

Experimental psychologists have repeatedly taken an interest in embedded pictures and their well-known obtrusiveness once they have been noticed (Wertheimer, 1912). It is therefore not surprising that in these experiments embedded pictures should provide a link between sensory physiology and psychoanalysis. The phenomena just discussed are related partly to subjective visual phenomena (Johannes Müller), partly to the delayed development of preconsciously perceived situations in hypnagogic states, which Purkinje observed in himself, and partly point to that characteristic of positive afterimages which Helmholtz demonstrated in his well-known experiments, namely, the regular appearance in positive afterimages of details which were not noticed during the previous fleeting glance (see, for instance, Ebbinghaus, 1911, Vol. 1, p. 263).

From the psychoanalytic point of view, however, the demonstration in these experiments of the lightningly rapid selection of an embedded picture so that it fits into subsequent dream work, extends Freud's findings about the principles of representation in dreams from the dream thought to the dream material, and appears to displace the time at which these principles exert their effects to the moment of the original stimulation. In this example, at least, it seems that the dream came about at the same time as the perception, and was separated from the latter in space and time only in the course of its delayed development. Just as the dream—like the illustrator of Don Quixote—represents by means of countless images what appears only as parable and allegory in waking speech and thought, so does it select from the visual forms an embedded picture, which is only a meaningless whirl in the waking state, but out of which—dissolving the whirl—forms of the slide emerge, clearly apperceived and outlined.

But these are not the only relationships that the psychoanalytic examination of this experiment brings out: it also reveals a new determiner of the apparent or real temporal sequence in this dream, namely, symbolism seems to determine the course of events in the dream, and to regulate independently the succession of dream images. However, it should not be forgotten that earlier, in the description of the experiment, we found a different, equally necessary and sufficient determiner, namely, the incipient eye movements. These can be established from the direction of the subject's gaze and from the configuration of the exposure [. . .[21]]. And now we observe in the illustrations of the experiment a third factor which, like the first two, seems to direct the sequence of the dream with absolute regularity. At first glance this appears to be a purely visual factor, without a demonstrable motor component. It concerns the speed and nature of the delayed visual development of the different groups of forms in the exposure: the ease or difficulty of and the shorter or longer time required for full development, depending on the visual field or on attention or on their form-quality.

Thus we find three totally different factors, a perceptual, a motor, and a symbolic one, which seem to determine the sequence of the development of the dream. However, a closer examination of the process shows that none of these three factors alone determines the sequence but, rather, each imposes its "period" upon the other two, with a result that may be compared to coupled oscillations.

The subject focused on the middle of the screen without rigidly fixating. As it happened, the point from which the subject looked at the slide nearly coincided with the position from which the picture was taken. Thus the "gap" appeared in paracentral vision, that is, under conditions favorable for the development of forms. But what the subject perceived during the brief exposure (Fig. 13) shows that the gap was not in the center of attention, probably owing, among other things, to the influence of the everyday street scene. At any rate, the content of what she apperceived shows that the entire width of the picture from the right to the left was perceived by her.

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[21] [Here and later, the omitted phrases or sentences contain references to biology, physics, or mathematics which are far-fetched in the light of present-day knowledge.—*Tr.*]

We can infer from the subject's afterthoughts in the waking state that this delayed development of what she perceived progressed—in relation to the visual field at the time of the original exposure—from the left periphery to the right, toward the center.

The subject first recalls that she saw two tall houses, one on the right and one on the left. In the description of the experiment this was regarded as an assimilation to an everyday street scene. The illustrations and the many experiments with the hallucinosis case make it necessary to mention the possibility that the trees in the picture may have contributed to the quality of "tallness," and were thus to some extent used up, so to speak.

"And there were not many people in the picture, not more than three or four, toward the foreground." If one actually makes the illusory row of houses end with the row of trees to the left, for instance, by blinking the eyes, one may easily receive a vague impression that there are only a few people on the street and that a group of them is toward the front.

The next morning: "First, those two high places. On the left it was like a long street." The development progresses toward the center, relative to the visual field at the time of the original exposure, but away from the center with reference to the field of attention-distribution at that time. The area around the gap, which has so far been a light continuum (Fig. 13), is beginning to differentiate. The remark made earlier (Experiment II) is valid for the representation of this light surface also. The first impression, during the original exposure, was certainly a darker and more or less homogeneous one. In the later development, during the period of oscillation, the "lightness" of this continuum was probably psychologically caused. I have many examples of this in my experiments; for instance, I have observed in certain suitable cases that the "vision nul" of a hemianopsic can be transformed into a positive scotoma by tachistoscopic exposures. Indeed, the various stages of the initial perceptions [of such subjects] show the development described here.

"There were three people in front; the ones on the right and on the left were tall, the middle one more to the front was shorter."

If we search the slide for a point of correspondence which has the size relationships of the human figures reported by the subject, we have two choices: the group of three men (left foreground), of whom the middle one is the smallest, or the group formed by the figures of the embedded picture and of the dream (Fig. 14), with the woman in white in the middle. But this female figure appears smaller than the other two only if we accept the solution of the

> embedded picture which was later developed by the dream, in which the head of the woman is omitted and the rest of the figure seems small. All this can easily be seen by anyone [looking at the slide] with rapidly blinking eyes. Anyone who has noticed that we usually look at pictures which are full of figures fleetingly, who has noticed the many agnosic errors we all make in doing so, will find this process familiar. In visiting a picture gallery, this sort of thing happens more than once to all of us.
>
> The question is now which of these two groups of three people was developed by the subject and reported as one of her afterthoughts. I believe that it was both, that is, neither of them. They mutually interfered with and fused with one another and thus acted as a brake on the impetus to further development,[22] without, however—as can be observed in many other examples—completely extinguishing each other as configurations. Because it is at just this point that the development of the impression in the waking state is arrested, no additional waking afterthoughts occur. Something seems to have gotten stuck. Instead, the development of the dream begins at this very point, with the appearance of the embedded picture, which fills the first scene of the dream. Here is a point like a branch point in an analytic function.

We find then, first, that an inhibition by interference (see Pötzl, 1916) is enough to determine the place of the incipient visual form development of the embedded picture established during the 1/100 second exposure. It is only an incipient inhibition, a tendency toward the inhibition of further development at just this point. We can establish some of the requisites of this tendency. At any rate, it is clear that all three processes mentioned above are involved, although they seem to play different roles.

One of the requisites of this inhibition lies in the nature of the preconsciously given visual forms, in the usual difficulty of clearly distinguishing single figures in a crowd of people. It seems plausible that this requisite is relatively independent of psychoanalytic factors.

The motor requisite is, at least partly, a simple consequence of the visual form factor. It seems that this tendency already contains as an effective agent what, in the usual look at a picture, makes the glance halt and forces it to linger, and at the same time often prevents fixation on just that place by providing no point where it can take hold, and results in a blurring of forms and apparent movements, thus blocking the development of an overview. This factor too may be regarded as relatively independent of psychoanalytic relationships. But it is immediately obvious that this independence exists in only some instances. Even in everyday perceptions, at least in prolonged ones, factors which lead to resistance caused by repression, and which can control the visual-motor factors, enter during the original excitation. So when in the experiment illustrated here a part of the incipient excitational complex is inhibited by interference and becomes shut off from delayed waking development, and thus becomes subject to the attracting force of repressed material, this reaction may be reached[23] from two sides.

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[22] At the same time they fixated the impulse at this point. See Pötzl (1917), particularly the fragment of a study of apraxia (p. 342).

This is one of the main Freudian conditions for dream development, and in the experiment too it is at this point that the dream development begins, sharply isolated from the waking development and apparently following only its own laws. Nevertheless, in spite of this sharp separation, it is connected with the waking development at the just-mentioned branch point, which appears to be a multiple point where the several aspects coexist.

> As is quite common in dreams, this dream first of all represents one of the inhibited and only incipient intentions: "Toward morning . . . I went into a store on this street." The very dream picture contains the place which I consider to be the branch point; it looks like an ordinary day residue: "It occurs to me: these three people . . ." I ascertained from the subject that these people did not appear clearly but seemed rather to be hazy, which is in accordance with their rather advanced development as forms in the waking state.

The first strong pictorial image in the dream is the arm with the knife: it forms the embedded picture. However, it arises quite spontaneously from the negative of what was consciously perceived in waking: although optically it is like a positive afterimage, it is a negative afterimage of what was apperceived. Here again is a clear example of the law of exclusion. Now it is obvious that in this case the embedded picture need not have originated at the time of the exposure; it could be placed, in accordance with Freud's views, in the period of dream work. At the time of exposure all the forms were given only as a tendency, containing various degrees of future facilitations and inhibitions. The embedded picture arose out of this raw material, as the forms surrounding it were successively used up and became firmly anchored in the delayed form development in waking associations. Thus it remained as a residue capable of exerting effects: in the dream work it becomes charged with repressed material which serves to activate it and to make it appear in its original form. In turn, the repressed material impresses upon the embedded picture its own meaning, out of which all the rest of the dream events seems to follow. The repressed material, while it has no form and does not contribute to the visual-motor reaction, functions as a catalyst.[24]

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[23] ["Reached" translates *erreicht*. It is unclear whether Pötzl is referring to the two ways in which the reaction can come about, or to the two sides from which we can understand it.—*Tr.*]

This greatly limits, for this example, our previous assertion that the embedded picture is formed at the time of the exposure. At the same time, it shows the nature of what must have been given in the instant of the 1/100 second exposure. At that time, at the point of inhibition through interference, a fragmentation of the original excitational complex has already begun. The [resulting] fragments are then pulled in various directions. One group of configurations always finds its way back to the remembered totality of the initial situation, even if this happens partly only in afterthoughts. The rest are separated, as if by a repelling force, and are drawn, as if by a new attracting force, to psychic material of the same degree of inability to reach waking consciousness. Only at the branch point do all these aspects coexist [. . .].

At first sight it seems that the further development of the dream simply follows the latent dream thought. But we must still examine how that dream development is related to the original direction of the delayed visual development determined by the visual field given in the initial excitation. It has already become apparent from the description of the experiment in the previous sections that the incipient eye movements, i.e., visual-motor directional qualities, reappear in the movement of the dream.

> In the next dream situation reported, the subject finds herself on a bridge and throws the knife, which she had snatched, into the brook. It should also be noted that the faint haziness of the female figure in nurse's uniform, which according to our earlier assumptions

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[24] [The context shows that the word "catalyst" is misused here, since Pötzl attributes to the repressed material a role far in excess of that of a catalyst.—*Tr.*]

> was already partly developed in the waking state, again favors the correspondence in which the person of the dreamer appears in the dream. Here the visual factor works as a catalyst.
>
> As if by an active, powerful wrench, the movement of the dream tears the subject's person away from the point of inhibition due to interference. Its subsequent direction is parallel to the direction of the scanning eye movement which must be made to bring the bridge into focus. But a look at the slide also shows that the bridge begins close to the point of inhibition and extends from the left to the right in the picture. Thus the main direction of visual development is the same in the dream sequence as it was in the waking afterthoughts.
>
> "Then what happened was that a child came to the brook, took the knife out of it, but now it was much larger than before . . ." If one moves on toward the center of the picture, one finds a possible point of correspondence for this dream situation too: close to the locomotive there is a human figure which appears to be far away, that is to say, small. The shadows on the platform provide further possibilities. People who easily form illusions will, considering the overdetermination of the dream, find many other possible correspondences for the "knife in the brook."
>
> Thus the visual development has almost reached the locomotive. In fact, the next dream situation does show the locomotive, which we are familiar with as a point of correspondence from the comparison of Figures 15a and 15b: "Then I escaped into a house and a lady took me in and took care of me." Now the development of the gap is completed and the dream ends. But this does not complete the reintegration of the initial situation. This is clear from the next experiment [with this subject] in which delayed developments appeared after several weeks.

Returning once more to the sexual symbolism of the dream, we find the inhibited sexual act at exactly the point of visual-motor inhibition and the dream ending in relative satisfaction and abreaction at the point where the visual-motor development reaches its resolution. The interpretation of the ending points to the sexual ambivalence reflected in this dream.

Thus the events of the dream have followed the rhythm of visual-motor development, and the latent impulses of the repressed followed the same rhythm. The completion of the delayed development of the inhibited motor impulse coincides with the wish fulfillment. In the content of the dream, the initial situation is reestablished in the form of a return to childhood or even back to the womb.

Thus the dream derives its movement and forms from the visual experiment, its meaning and events from repressed psychical material. The rhythm in which the simultaneity of the visually given was transformed into the successiveness of what developed determined the harmony and movement of the dream melody. The visual direction of the form-creating process, the development of the incipient motor impulses, and the sequence of the dream events are attuned to one another and form a unitary space-time transformation.

During sleep, that is, during this state of inhibition of motor impulses, the eye movements are transformed into perceptions of movement, which apply both to the person of the dreamer and to what is being dreamed. It is not improbable that the motor block also plays a part in the enlargement which the forms of the dream are subject to. The cohesiveness of the waking-conscious complexes has become movement and events.

If we review the results, we find that the incipient complex is very simple, and the fact that it arises in such a short time loses all its mystery. What we are dealing with is a continuum of degrees of facilitation and inhibition, which are set in motion by and apply to visual material which is perceived actually and fully, though preconsciously. This material has the potentiality for, but mostly still awaits, development. The closest analogy to this process is the latent effect of light on silver salts in photography. Here too the exposure to light merely establishes a potentiality for a chemical process which will become active only in the process of developing, after which no further potentiality is left. I may round out this familiar comparison by referring to the Korsakoff psychosis; it may be considered a disorder of the process of fixation[25] which cannot, or can only slightly, attack what is already fixated. Here, however, all I want to show is that even the process underlying the technique used to illustrate these dreams, that is, the photographic procedure, correctly represents this mental process, and that there are, so to speak, mentally underexposed as well as overexposed films. The phenomena of contrast and irradiation in vision would long ago have called attention to this if, in addition to the retinal conditions, the coactive central processes had been sufficiently taken into account. It seems that almost every visual phenomenon is centrally and peripherally determined, not centrally *or* peripherally. Still, under certain conditions, depending upon the design of the experiment, any visual phenomenon can be taken to be purely retinal or purely central.

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[25] ["Fixation" refers to a part of the process of developing photographs.—*Tr.*]

The mutual relation that we have seen in this experiment between the three direction-determining factors, namely, the mutual imposition of "periods," proves to obtain for all visual activity. According to the analogy with forced oscillations, these factors will exert optimal influence on delayed visual developments when their periods are identical and their directions coincide. The next experiment will illustrate this condition.

Fourth Experiment

Figure 16 represents the slide. It should be remembered that the subject saw it in indirect vision, so that the approximately straight upper edge of the Nile steamer coincided with the right half of the horizontal meridian of the binocular visual field. We can more or less reproduce this impression if we look from normal reading distance somewhat to the left of the picture, but we must remember that the strong light used in projecting the slide offers favorable conditions for indirect vision. On the other hand, the picture was exposed for only $1/100$ second, an exposure time which precludes any eye movements, a particularly important fact in this experiment.

Figure 17a reconstructs what the subject perceived in $1/100$ second: "A small house. Two rows of windows." This photograph is too sharp, the forms are too clear. But it seems impossible to render in a photograph even approximately the peculiar haziness of this complex picture seen in indirect vision, its indistinct fluctuation back and forth, the advance and retreat of its parts. The picture represents only the sum total of what the subject saw; it illustrates her description, not her impression.

Almost everyone who sees Figure 16 in indirect vision will find that the white triangular surfaces of the two sails are obtrusive and particularly predominant. It is easy to discover that in continuous fixation, with Figure 16 in indirect vision, the two sails alternate with each other, one becoming prominent and the other receding. In between, the rows of windows come forward. Ultimately this play of partial impressions yields to a somewhat more cohesive image, which can easily take on the form of the Swiss house in Figure 17a, particularly if good will fosters the illusion.

In this subject an assimilating upward displacement of the sails undoubtedly occurred (Fig. 17b). The subject's drawing of her impression proves this, since the triangular area shows up high in the picture as a roof gable. But the wind-blown roundness of the swelling sails is still present, misshaping the front wall and threatening the house with collapse. It should be noted that since the subject can draw a house with straight lines, it may not be unjustified to ascribe the exceptionally bad quality of this drawing to the persisting influence of what had been seen in indirect vision.

This emergence and disappearance of parts of complex pictures in indirect vision makes it understandable how easily simultaneity can change into successiveness. Apparent movements, even the perception of several objects as one, as almost simultaneous, in quick succession, or as merging into one another, etc., actually all occur quite frequently with tachistoscopically exposed pictures seen in indirect vision.

Here, the exposure time being $\frac{1}{100}$ second, these phenomena probably occurred after the original excitation had ceased. This shows that they can occur despite so short an exposure time. I was easily able to confirm this both before and after the experiment by simple tachistoscopic exposures to other normal subjects. The fluctuations of such partial impressions following the original excitation correspond to the rhythm of afterimages. All these phenomena can be classed with Exner's afterimages and Stigler's (1910) metaphotic pictures. They also furnish a clear transition to the visual dream reaction (in accordance with Wundt's views).

It may therefore be assumed that in this subject too, in spite of the $\frac{1}{100}$ second exposure, the same kind of oscillation of partial impressions, of singly perceived visual groups, took place that occurs in continuous exposures in indirect vision. If this is the case, the assumption indicated earlier in the description of this experiment may perhaps no longer seem quite so arbitrary. It is conceivable that the alternating appearance and disappearance of the two white sails is reflected in the dream movement of the two companions: "I was walking along a very wide forest path with two young ladies (nurses, according to one of her associations). One of my companions got lost in the woods, took a road to the left; [that was] the young lady who was still with me; I lost the other one completely." The continuation of the dream report is inconsistent; this companion is mentioned again: "She said she would rather stay in the forest." It would seem that these two persons alternate in the dream story in the way that the two sails alternately appear and disappear in indirect vision. It turned out that the subject could not visually remember the dream companions; they were derived from an ordinary day residue of a walk that evening.

Of course, here we are dealing with a hypothetical relationship. But on the one hand I am striving, as much as possible, toward a complete sensoriphysiological analysis of the dream, although

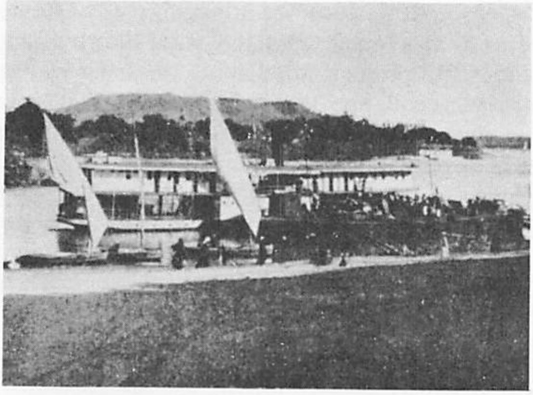

Fig. 16

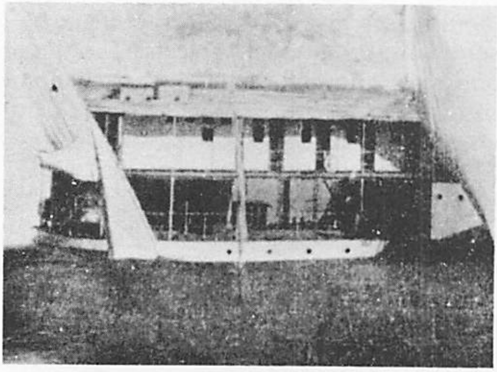

Fig. 17a

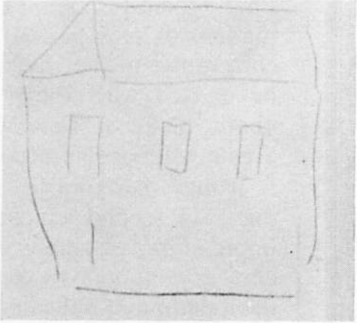

Fig. 17b

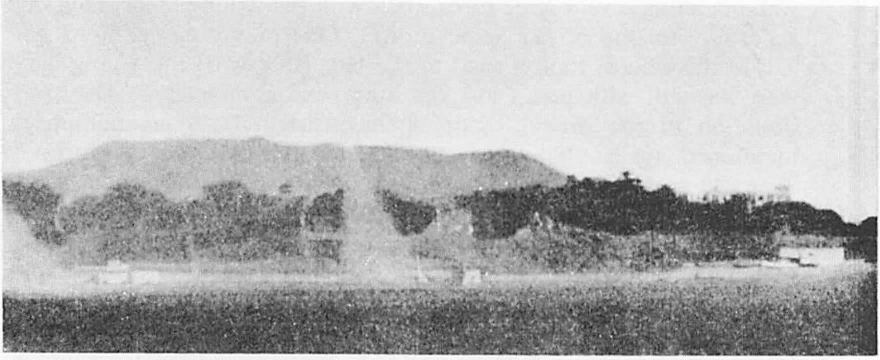

Fig. 18

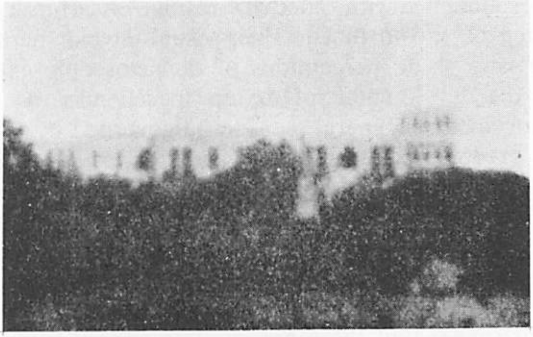

Fig. 19a

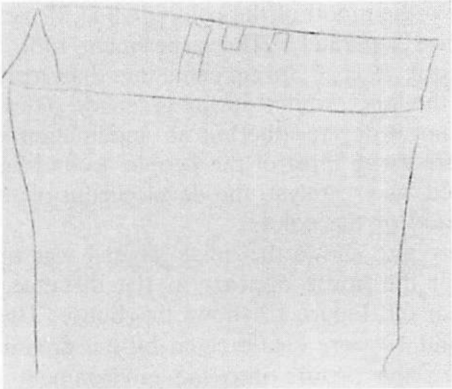

Fig. 19b

sharply distinguishing between unquestionable relationships and those that are merely possible. On the other hand, I am constantly trying to test, even on merely possible correspondences, the validity of the mutually exclusive relationship between waking, conscious, visual perception and dream. This relationship would be present here too if we assume that a correspondence exists. The fusion represented in Figures 17a and 17b would have taken place in waking-conscious perception; since, owing to the circumstances, this fusion was uncertain, vacillation between simultaneity and successiveness persisted, and thus the relationship of exclusion could permit, in the dream, only the representation of the restless back and forth movement of the two impressions, that is, of the phases before fusion.

The correspondence with other day residues is arbitrary, but at least it can often be shown that in their visual development, they follow the same laws as do perceptions of tachistoscopic exposures. Incidentally, the development of dream speech and the conditions of dream movement in general seem to be governed by analogous laws, with the exception that, if the relation of exclusion is universally valid, in ordinary conditions not only underexposed but also overexposed impressions must become potential dream material as their percepts fade. This is easily confirmed by experience.

Figure 18 condenses the subject's dream into one picture which seems relatively faithful and not very dreamlike. It is in the nature of the experiment that the representation should turn out that way. It must be taken as a particularly vivid dream picture, in contrast to the shadowy figures in the subject's dream in the earlier experiment.

Here is the "beautiful straight path, rather narrow, so that two people could walk on it." Here too there are "just bushes on the sides." The mood of the dream, "everything was green, as in spring," corresponds to the mood of the colored slide, if we take the point of correspondence separately. The experiment took place at the beginning of April, 1916.[26] Spring came late that year, and as yet there was none of the long-awaited spring greenery. Thus what comes into play here is not a day residue but an anticipation which the subject probably shared with most of the people around her. This may well have furthered, as a catalyst, the development of the preconsciously perceived mood of the colors.

This picture also shows the hill ("Then I was on top of a hill"). From the hill the house appears in the distance, as the dreamer saw it from far off. Figure 19 shows this house. The enlargements of Figures 18 and 19 were also created by the dream in its own way: it transformed the picture into the environment of the dreaming self. Such enlargements are common for parts of our bodies when they appear in a dream, and also for impulses which work their way through the motor block of the dream and make themselves felt with tremendous impact in the dream experience. This process of enlargement is familiar not only from the dream but also from the macropsia in disturbances of accommodation, from the aura in Jackson's epilepsy, from the kinesthetic hallucinations in mescalin intoxication (Serko, 1913), etc. The element common to all of these conditions is the break-through of an inhibited impulse which enlarges the appearance of the given mental content.[27] Here we may take the inhibited and delayed impulse to be the incipient scanning eye movement, which originated in the preconscious perception of the picture, and whose direction is obvious.

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[26] [A misprint for 1917.—*Tr.*]

[27] The relation of this kind of reaction to the well-known Liepmann-Kalmus separation error [*Teilungsfehler*] in hemianopsia requires no further discussion.

This example shows how incipient eye movements are transformed into movements experienced by the dreamer, and at the same time enlarge the dream image to various degrees. That in the present instance [the enlargement] is attuned to the dimensions of the dreaming self's surroundings is a special case, though a rather frequent occurrence both in these experiments and in ordinary dreams. Of course, a reduction in size, or the regular transition from micropsia to macropsia which is common in nightmares, may also occur.

It is not surprising, then, that the distant house on the riverbank appears as clearly in this dream as Figure 19a shows. It must be remembered, of course, that the projection, enlarging the slide, provides far better conditions for the delayed visual development of the house than could be surmised from Figure 16. At any rate, of all the visual groups in the slide which underwent delayed development in the dream, the house was the furthest toward the periphery of the visual field.

Figure 19a (the house) ". . . seemed different from what it looked like in the picture. It was much longer, it had an attic but no roof."

Figure 19b shows the subject's drawing, which adds the windows to her relatively accurate description of the house on the riverbank; they appear directly below the horizontal line of the flat roof. On the other hand, the picture involves a condensation with Figure 17b, in that it takes over the triangular shape of the sail which played a part in the construction of the roof. The condensation in the drawing parallels the subject's equating of the two houses in the dream story, though their visual form was different. But the attic mentioned in the description is absent in the drawing. Thus the drawing and the narrative complement one another in many respects, and only together do they constitute the whole complex. The reaction is similar in character to the interplay of the components effective in the speech training of aphasics which I have described (1916).

All the spatial-visual relationships between dream picture and slide that have been demonstrated thus far are unquestionable. They were not subject to any [external] influence. This is not the case for the meadow or field to the right of the forest path in the dream, represented in Figure 18. In preparing the representation we applied the relation of exclusion between the dream picture and the other parts of the slide. When the subject saw this representation and was asked whether it was accurate, she answered affirmatively without reservation. When reminded that she had spoken of a forest path, the subject said: "It was flat to the right; a meadow or a desert." To

> the bottom of the slide there is a brown surface, which looks like ground.
>
> Here again a retroactive illusion from the representation to the dream, or a memory from the later inspection of the slide, could have played a role. Unlike the relationships described earlier, such confirmations yield nothing conclusive. Nevertheless, it is of interest to establish whether the representations are accepted or rejected by the subject, although these details do not affect the main results of the experiment.

This example of a vivid and faithful dream picture is the more easily compared with the type encountered in Experiment III since the subject was the same in both. In Experiment III the dream images are shadowy and meager; as the course of the experiment shows, they correspond to a point where inhibition by interference set in. In Experiment IV the dream images are abundant, vivid, and faithful to the manifest forms of a strip of the slide and are not, as in Experiment III, insinuated into the slide as embedded pictures. On the sensoriphysiological side, there are two factors which quickly explain this difference. In the first place, as far as I can tell, no part of the strip of the slide [in Experiment IV] was developed in waking, conscious afterthoughts, and therefore the whole area was available for dream development. Secondly, several factors worked together, enhancing the vividness of this dream development, whereas in Experiment III inhibition and a conflict of several factors were obvious.

The strip of the picture appeared in the right half of the horizontal meridian of the peripheral visual field. As I have already pointed out in describing the experiment, this meridian is particularly likely to be visually developed in right-handed people. Likewise, the movement inherent in the forms of the picture goes from left to right, like the left to right development in the dream, which the dreamer experiences as her own movement in walking toward the river bank ("on the forest path"). The river itself does not appear in the delayed development. It is possible, although it cannot be proved, that the idea of its flow contributed to the complex of the dream movement. Finally, the scanning [eye] movement, going from the main subject of the slide toward the landscape, that we make in taking an ordinary look at this picture, has the same direction as the situation in the visual field and the movement indicated in the forms of the picture. Here these three factors are really no more than three different aspects of the same main phenomenon. What is most peripheral in the visual field at the time of the original excitation is, other things being equal, likely to be the last in spatial-visual delayed development [. . .]. It will be reached last by the ordinary scanning movement of the eye, which starts from the main figure as the center of observation, and it will elicit the relatively widest excursions of real eye movement [. . .].

This unanimity of the three motor factors in development more or less prescribes a continual dream movement, which proceeds in the andantino, quasi allegretto, in which the dream experience itself seems to be composed. Thus this dream, in spite of its identical personal note and the many similar features of its symbolism, contrasts with the dream of Experiment III, whose rhythm was appropriate to transforming the visual blocking at the point of interference, and the wrenching of the glance away from this point, into a dream experience. In the analysis of the dream [of Experiment IV] too, autobiographical factors rise to the surface, saturated with infantile material from the forest country from which the subject came. The allegory of the path of life is obvious enough. The phylogenetic depths (see Hess, 1913) out of which the incipient visual impressions, originating in peripheral vision, develop, may likewise be attuned to the depths of the levels of memory out of which a wish-laden world of childhood—submerged but ever ready for development—arises, to take on the visual forms given [by perception] and provide them with content.[28]

It can therefore be said here too that the delayed visual-motor development imposed its rhythm on the dream experience, though from the point of view of psychoanalysis it is the dream experience which appears to be completely dominant. In this connection it might be asked what in this experimental setup was particularly conducive to dream formation. In principle, almost all impressions received in indirect vision are suited to become dream material. But if we consider the factors which determine the selection from this multitude under normal conditions of dreaming, we find, along with the analytic factors discovered by Freud, influences of excitations originating in the experiment itself.

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[28] I recommend that the experimental setup described here be combined with measurements of the depth of sleep, in order to examine the often-discussed relationship between certain types of dream contents and the depth of sleep from which the arousal stimulus brings awakening. Such a combination would be particularly appropriate since a strikingly large proportion of the positive visual dream-reactions occurred in arousal dreams. However, in this setup it would be even more difficult to keep the subjects in ignorance of the purpose of the experiment. See Pilcz (1898).

The main type of dream-arousing excitations are probably inhibited intentions of any kind. All the experiments described here contain such intentions by virtue of the tachistoscopic exposure itself. In setting up the experiment I counted—and not in vain—on the subject's curiosity as a driving force likely to strengthen the affective emphasis of these inhibited intentions. Thus all these experiments involve a particular set[29] which affects at least a considerable number of subjects. This set was further intensified in Experiment IV by a variation in the setup, namely, the perimetric arrangement, which both fosters and inhibits the tendency to reinstate the corresponding situation in the first experiment [the subject participated in].

> This is reflected in the ending of the dream. The subject enters the house and sits down in a niche at the window. It was, however, in the first experiment that she sat in the window niche. This time she stood in the middle of the room.[30] The ending of the dream completes the delayed development of the situation of the first experiment [the subject participated in] and culminates in a branch point between the two experiments. The tendency to reintegrate an earlier terminal situation may well considerably strengthen those intentional operations which seem to be necessary for the appearance of delayed visual developments in the dream.
>
> Again, along with the ending of the dream, the visual development is also completed in a main meridian (here from left to right) almost reaching the edge of the picture. It is as if the end of the dream experience were identical with the end of the belatedly developed scene. At first sight this appears to be questionable: the alarm clock awoke the subject; she was angry and wanted to go on dreaming.

It would be convenient to explain this in terms of the material of the experiment, by assuming that the lower strips of the slide still awaited development and a new experience in a new dream fragment would have accomplished this. But there is nothing to suggest this, either empirically in further observation of the subject or analytically. The very fact that, as far as the subject's self-observations go, the arousal stimulus does not seem to have entered the dream material, seems to suggest that what took place was actually a kind of terminal scene, and that the unconscious processes had reached their natural end, even if against the subject's conscious will. The main direction of the wish, revealed by the analysis of the dream, cannot be discussed here, but the analysis does strongly suggest that at this point "the brakes were put on," which would be in accordance with a sudden awakening. This circumstance is a good illustration of much that Freud asserted about the role of sensory impressions during sleep and objected to in the one-sided sensoriphysiological theories of dreams. It is also related to the common experience that we rarely succeed by will power in resuming a beautiful dream which has been interrupted, although different aspects of the same latent dream thoughts may often be pictorially represented in a succession of dream fragments (Freud, 1900, p. 333ff.).

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[29] [*Einstellung.—Tr.*]

[30] [Since nothing has been said about sitting in a niche in the *material* of Experiment III, nor about standing in the middle of the room in the *material* of Experiment IV, it would seem that this passage makes sense only if Pötzl is referring to not previously mentioned facts about the experimental *setup.—Tr.*]

The perimetric arrangement of the experiment makes the laboratory setup very similar to everyday conditions. It is suited to demonstrating the effectiveness of indirect vision as a source of dreams. At the same time, the action of intentional factors shows what it is that usually limits this effectiveness, aside from mental disturbances. I consider the obvious motor origin of these factors to be of great importance for sensory physiology; this origin influences the delayed development of peripheral visual impressions and of the memorial elements related to them. My studies of agnosic patients have shown me that the virtual scanning eye movements are the binding force which creates the simultaneously apperceived form complex in which the original excitation and memorial effects are brought into a homophonic correspondence.[31] In these experiments it is the persisting effect of the incipient eye movements which brings forth, piecemeal, at intervals of varying length, in a succession of visual Gestalten, what was once a simultaneously given complex [. . .].

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[31] My cases of relatively isolated agnosias for particular visual qualities show this. These disturbances spontaneously collect around certain average positions of the gaze. The averages must be taken over very long time intervals. This principle also explains the selective mechanism of pure word blindness, in which the accompanying disturbances of the overview, though usually present (von Monakow, 1905), are insignificant. In Lissauer's visual agnosia, reading disturbances are again relatively insignificant. Wertheimer's and my joint studies have first of all established for pure word blindness the general principle of the processes in visual agnosia, in accordance with Liepmann's conception. The selectiveness of this agnosia, however, needs a specific explanation, which I believe I can provide.

IV. THE GENERAL CHARACTERISTICS AND CONNECTIONS OF THE REACTION

In the foregoing I have reported only a few of the experiments which I have completed and illustrated. The selection was made with the intention of avoiding a discussion of the visual dream reaction beyond what was already required by the subtlety of the details to be discussed. The experiments described may be considered prototypical of this reaction, since the relationships observed in them recurred regularly in almost all the other experiments. The subsequent experiments brought supplementary results. Some of the experiments with normal subjects yielded information about the temporal aspect of the reaction, its beginning, its culmination, and its fading away. Other experiments established why it is impossible to determine a lower time limit for the effectiveness of tachistoscopic exposure. Additional experiments show how the reaction can be applied to the study of psychoneuroses. But above all, I have called on the reaction in furthering the recovery of my patients with focalized lesions of the narrower and broader visual spheres, with results which are partly of sensoriphysiological and occasionally even of practical significance. In such cases it is sometimes possible, though generally only after long practice, to elicit from the peripheral part of the preserved visual field a firmly anchored series of afterimages which is displaced toward the scotoma, and to put these residual effects gradually into the service of the restitution of form vision in the relative scotoma. However, this is possible only in certain specific conditions which cannot be discussed briefly.[1]

I reserve for later publication the discussion of these special connections of the reaction, as well as the discussion of their theory which I have succeeded in working out extensively. Though the reaction is made up of a great variety of phenomena, its process is simple enough to lend itself to mathematical treatment under certain limiting conditions which were easily fulfilled in the experiments. The mathematical treatment [I have in mind] is intended to be more than an analogy, though, of course, due to the nature of this reaction, interpolations are out of the question. In the following, however, I only want to stress some points which I consider essential for the qualitative characterization of the reaction. A summary of the procedure followed in preparing the representations should help to introduce this discussion.

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[1] In one case I obtained, by means of prolonged practice, with a summation of tachistoscopic stimuli on the region of the (right-sided) relative hemianopsic scotoma, a positive afterimage which was persistently displaced to the left, i.e., toward the intact side of the visual field. In the interference experiments I occasionally obtained mirror displacements by this procedure.

To be sure, the illustrations used here do not show all the obvious and easily carried-out applications of the method. The way in which underexposures can be used, the effect of the contact between [photographic] negative and positive [in developing], and finally the possibility of bringing about condensations, will become clear only in the illustrations of the later experiments. Likewise, the regularity of the relationships between the visual effects which determine the background of the dream picture and the phases of restitution of cortical blindness will not be shown in detail until later. Nevertheless, we may summarize by asserting that the assumptions made at the beginning of the previous section are verified, since each technical trick used had an easily recognizable equivalent in the physiological process that it was to represent. For instance, the covering of certain parts by retouching represents the constant relationship of exclusion which replaces groups already developed as Gestalten either with "vision nul" or with one of the phases of the period of oscillation which occurs during the aftereffect of an original excitation. The fact that the pictures of the dream images, when the background and the developed forms are superimposed upon one another, yield an approximation of the total original excitation, simply shows that a succession of visual aftereffects, separated by irregular intervals, has developed—in the form of isolated partial impressions—the material which at the time of perception appeared as simultaneous and fused mental content held together by virtual eye movements. The use of subsequent overexposures is in good agreement with the oscillating phases of series of afterimages and with the role attributed by Wundt to the chaos of light in a visual field cut off from the external world in the formation of dream pictures. Finally, the use of enlargements and reductions is justified not only as an attempt to represent a dream content as it appeared in the subject's own reports; the fact that the stimulus is objectively given[2] in the experiment allows us to conclude that an enlarging and reducing function is part of the dream process itself. This made it clear how the blocking of impulses during sleep, which has always been considered to be related to the sensory vividness of the dream images and to their enlargement and reduction, operates through incipient eye-movement impulses. The assumption of so-called eye-movement impulses has played an important role in certain theories of visual perception of space and movement, though no specific conception of such impulses exists. My experiments show that these incipient visual-movement impulses can be made visible and subject to observation [. . .]. It also becomes clear that spatial and temporal blocking are to some extent coordinated with each other here, so that the break-through from the depths of the past and the break-through of the inhibited eye-movement impulses of the present have more or less the same direction and are to some extent comparable. Thus the infantile regression in dreams discovered by Freud is connected with a regression to previously seen dimensions which can be explained in visual-motor terms [. . .].

The applicability of our results can be tested on a randomly chosen, still controversial problem of the dream. As an example we might choose the law of dreaming which was asserted by Pilcz (1898), though contested by others. Pilcz asserts that dreams containing memory images of the distant past mostly occur in deep sleep. My experience confirms this observation for the majority of dreams, and the proposition is in agreement with my experiments, in that the depth of sleep is *one* of the factors which can increase the motor block in dreaming. A second such factor is Freudian "repression," and a third is the character of the incipient impulse in question. These and other factors will interact in various combinations, but my experiments show that at least occasionally a kind of resonance occurs among them. Pilcz's claim, from self-observation, that clear day residues of the most recent past appear only in light sleep is in agreement with my observation that for the most part morning dreams provide the optimal conditions for dream reactions to tachistoscopic exposures. On the other hand, the results of the experiments show that the assertion that every new experience (*"be it ever so impressive"*)[3] generally needs a strikingly long time to emerge in a dream must be limited to impressions fully perceived in waking consciousness, which must fade before they acquire, by way of temporal transformations in memory, those qualities which preconsciously perceived daytime impressions have right away. With this limitation, the assertion is confirmed by experience; for instance, it is confirmed in dreams after the death of a beloved relative. The assertion is also limited to the visual, or, more generally, to the sensory [manifest] form of dreams, since Freud's dream analysis has brilliantly shown that almost every dream contains a recent day residue at least latently. This is of course confirmed by the experiments described here. Thus two essentially correct but seemingly contradictory propositions are shown to be compatible by the demonstration of a general principle.

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[2] [Pötzl apparently means that the size of the stimulus is known.—*Tr.*]

Pilcz, in agreement with Lasègue, gives an example showing that paranoiacs in general do not dream of their delusions and hallucinations, and explains this by his proposition discussed above. Lasègue's passage, cited by Pilcz, suggests that the mental patient need not dream *"son délire diurne"* because he already has it. Lasègue compares this with the cessation of choreatic restlessness in sleep, which can easily be explained, even according to the newer theories of chorea,[4] by the assumption that in chorea an inhibition is suspended which ordinarily blocks the immediate transformation of the incipient impulse into movement. Bleuler contradicts Pilcz's assertion on the basis of experience with schizophrenics, gathered at the Zurich clinic and elsewhere (1911, p. 440). It is in fact fairly frequent, in Magnan's paranoia, for instance, for the incipient forms of patients' delusions of grandeur to appear first in fantastic, significance-laden dreams. The patients ascribe even more prophetic significance to these dreams than popular belief has always attributed to dreams. It should be noted that Pilcz's example refers both to ideas of persecution and physical delusions, and to the hallucinations accompanying them. Here we must keep in mind one of the well-known, basic characteristics of paranoid ideas of reference: what intrude into the patient's picture of the world are always just those impressions which are on the periphery of consciousness, which obtrude in passing from indistinct conversations, from glances, from facial expressions and gestures, from barely intelligible, ambiguous passages of texts, etc. [. . .]. What enters the consciousness of such patients, while their perception of the dominant impressions of the world picture is increasingly impaired, is exactly what normal people preconsciously perceive in indirect vision and hearing, but suppress by processes of abstracting. Here too we can simply apply the law of exclusion whose strict validity is illustrated by the experiments we have described: what has been developed in the waking state, no matter if it was fully conscious or preconscious at the time of the original excitation, is excluded from development in the dream. This is just what happens to the actual daytime deliria, but is not necessarily the case with all the delusional complexes. It is a well-known clinical experience that in Magnan's paranoia the incipient forms of future delusions of grandeur can often be demonstrated in the patients' dreams very early, when their unfolding in the waking state is still inhibited. Often they first manifest themselves in voices, which frequently appear first in dreams, in which case they are but a particular example of an inhibited intention being later developed in the dream, just as the blocked intentions in general were in the experiments described. Even the range of affects involved in the inhibition and the break-through of preconscious mental phenomena in general seems to be parallel to the development which is brought forth either in a successive or in a simultaneous form by the basic moods of the transformation in Magnan's paranoia. This confirms the agreement of the Pilcz-Lasègue observations with experience, and both acknowledges and dismisses Bleuler's contradicting observations. It also becomes clear how the experience gathered in these experiments can be applied to the field of schizophrenia,[5] where it serves as a bridge between Freud's and Bleuler's conceptions, and between Stransky's (1903, 1905, 1914) dissociation theory and Berze's theory of apperceptive disturbance, just as it did between Freud's dream theory and sensoriphysiological dream theories.

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[3] The italics are the author's.

[4] Besides the classic theory of Bonhoeffer, von Economo's conception (1910) particularly deserves attention.

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[5] See the splitting of the complex in Experiment III, for instance. The parallel between dream and schizophrenic delusion suggested by Bleuler is particularly relevant (1911, pp. 439-440).

Pilcz relates the lawfulness found in dreaming to the partial waking and partial sleep of the cortical elements, of which the ones called upon most often during the day will be the first to be put out of action in quiet sleep, pointing out the analogy between this and the disturbance of memory for the most recent past which is the essence of the Korsakoff type of memory disturbance, in simple senile dementia, for example. This analogy is undoubtedly important, and is also related to the result of my experiments. Judging by common observation, apperception of the most recent events becomes increasingly fleeting in presbyophrenic disturbances; and according to my experiments, the fleetingness of perception is the factor which opens the rich infantile springs of the dream world. How they may play into the experiments will be shown by examples from my later series of experiments. Moreover, the disturbance of memory in presbyophrenia is only a pathological caricature of a general physiological process. The persistence of the memorial power of excitations starts to decline at an age when perception has just reached its full height and optimal speed. Here too we encounter a contrast between memorial aftereffect and perception, extreme forms of which we have seen in these experiments.

However, the cortical elements drawn into this analogy do not seem to have a place in it. In anatomically oriented investigations, attempts have occasionally been made to relate the layering of memories to the cortical layers; in this connection the example of general paresis has often been employed, in which von Wagner-Jauregg's "Atz-reflex"[6] and the return to the embryonal position seem to demonstrate clearly enough that the lowest layers of memory persist longer than the others, analogous to the typical pattern of cortical destruction in which certain cortical layers are probably relatively well preserved. This [conception] has been used, time and again, to force certain groups of memory pictures or engrams, or whatever they may be called, into certain groups of cortical formations.[7] But if we keep within the limits of what can be definitely established, we observe only states of total innervation. The automatisms which accompany [such states] stem from similar states of total innervation. It is just an illusion that the memory engrams are in the cortical cells; we cannot show that they are there. The most we can say is that comparable conditions of innervation bring about comparable reactions to excitation from the external world. In other words, identical internal situations tend, within certain limits, to reintegrate the same reactions to the external world, whether the conditions in the external world are the same or not. In the example chosen, the analogy with total situations of the phylogenetic and ontogenetic past is determined not only by the more advanced destruction of certain cortical formations, but also by the demonstrable, though less advanced, affliction of the rest. We could just as well assume that this affliction effects a regression in the sense of Stricker's theory of inflammation and thus fulfills the conditions for the return of a total internal situation. It can be shown that here too, just as in all localized brain destruction, the absence of certain formations in a total process has consequences similar to the consequences of the immaturity of these formations. In this sense, von Wagner-Jauregg has, for instance, pointed to the choreiform character of the child's movements in the first year of life. But this does not permit us to conclude that this total process is tied to localized areas, like glandular secretion to gland cells. Such an analogy is made most unlikely by the great biological contrast between gland cell and nerve cell.[8]

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[6] ["Wagner-Jauregg has demonstrated that a primitive eating-movement, the Atz-reflex or infant-reflex, reappears in high-grade organic dementia . . ." (Schilder, 1924, p. 235).—*Tr.*]

[7] It is obvious that in such cases the concept of the engram is not used in Semon's sense. I employ Semon's terminology frequently here but try to abide by his usage.

All that can be directly observed is the tendency to reintegrate previous total situations in reactions. This tendency to reintegrate is clearly shown in the results of the experiments described here. The pictures, when superimposed upon each other, reintegrate the picture which was originally exposed, and the dream report reintegrates the rest from the earlier corresponding whole situation. Here we are dealing with actual memory images, but they are memories of something that was never consciously experienced, like the aftereffects of fleeting lights. Freud has pointed out that the embryonal position is the natural resting position of the sleeper and regards it as a regression in his sense of the word. The similarity of the sleeping position to the embryonal position in terminal dementia is obvious. If now, according to Freud, certain dream images betray, in their hidden symbolism, a tendency to reintegrate these internal situations of the past, this is a view which is empirically at least as well founded as the relationship [postulated] between general paresis and the cortical cells in the example given above. My experiments show, or at least suggest for a particular example, what those layers could mean which, when superimposed upon one another, reintegrate the situation. Each layer, which by itself appears as a covering veil, represents a somehow characteristic section of the oscillation in the period following a fleeting excitation. The rhythm of this oscillation has always been compared to the oscillations of a pendulum after an impulse, and thus these phases of oscillation can well be compared to the movement of the pendulum in various resisting media (see Pötzl, 1916; Hertz, 1916). It is possible that this familiar comparison may also help to clarify the characteristics of these phases of oscillation. At any rate, nothing is learned about them if we consider them as somehow produced by groups of cortical cells or other elements of the nervous system, and stop there.

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[8] It is my opinion that such expressions as perceptual and memory centers, or perceptual and memory cells, should disappear from the literature until their exact empirical referents are found, that is, perhaps forever.

The relationship between the layering of memories and the architectonic layering of the cerebral cortex may be rather similar to the one I proposed in my initial discussion of the procedure of representation, that is, about the application of photographic methods in the study of neurofibrils and in the illustration of impressions from tachistoscopic exposures: I suggested that the photographic representations are analogous to the neurofibrils and impressions from tachistoscopic exposures respectively [. . .].

The application of the reaction to an arbitrarily chosen example has, thus, essentially pointed up connections with and bridges to already existing but seemingly heterogeneous conceptions, and has shown that they seem heterogeneous only so long as they are not considered in relation to one another and mutually contradict one another. This criticism is perhaps least applicable to psychoanalysis, which has, so far, been rejected without examination by its opponents among the experimental psychologists and clinicians, whereas Freud, as far as I know, has never rejected the results of the investigations of these opponents, but has only emphasized the differences between his and their methods and aims. The experimental psychologists, however, have often reproached psychoanalysis because with the exception of Jung's association experiments and Schrötter's dream experiments, it has made too little use of the exacting experimental method. I have reservations about Schrötter's dream experiments because the use of hypnosis and therefore suggestion introduces a complication. My aim in my own experiments was to eliminate this very factor. Anyone who will take the trouble to examine the experimental setup will be convinced that it was just as easy to avoid suggestion here as it is to avoid, in the study of aphasia, a falsification of the results by involuntary gestures [of the investigator] and by the patient's lip reading. Moreover, unbiased and close consideration of the results themselves shows that they could not possibly come about in the form described here either by way of autosuggestion or by external suggestion. I believe that in these dream experiments I applied an idea similar to the one which guided Freud twenty years ago when he eliminated hypnosis and suggestion from the study of the psychological relationships in psychoneuroses.

There is one more objection to be considered, namely that the relationships described here between the dream images and the original excitation are nothing but an accumulation of coincidences. Should this objection be made, I would refer to the "Jeu du Treize," and to Moivre's problem and Laplace's calculation connected with it. If somebody should succeed in developing a similar theorem concerning the conditions of this experiment, which would yield a number larger than 10^{-8} for the probability of a geometrically true correspondence, then this objection may have to be considered, but until then I feel entitled to ignore it.

I consider the results of these experiments as experimental illustrations of Freud's dream analysis, and as suited to bringing it closer to experimental psychologists and their methods. But what is the significance of this method for psychoanalysis itself? In my opinion, this dream picture-book was not needed to prove the empirical validity of the major facts and assertions of Freud's dream analysis. I believe, nevertheless, that my results are important for dream analysis, since they extend its laws to the sensory material of the dream and to the general mechanism of the simpler innervations. Moreover, they provide psychoanalysis with the desired bridge to sensory psychology and to the physiology of the nervous system. As these experiments generalize the principle of wish fulfillment of

Freud's dream theory to the general tendency of inhibited acts to reintegrate, they also highlight the significance and power of the selective factors discovered by Freud, particularly in the sensoriphysiological aspect of dream formations.

It was not my original intention to provide experimental proof of Freudian dream analysis by means of these experiments, i.e., to prove something which has, in my opinion, long been proved. This aspect of my results came about incidentally, and I could not pass it by, because it was so rich that I felt it my scientific obligation to expound on it in detail. These experiments arose from considerations of pathological brain conditions, and I carried them out in close connection with the problems I was faced with in re-educating patients with visual disturbances of cerebral origin. For my field of work, the sensoriphysiological aspect of these experiments is the more important one. In what follows, therefore, I must discuss the extent to which these experiments fit into long-known facts of sensory physiology and to what extent they contribute something new.

It has already been pointed out, in the introductory section, that the basic facts on which the experiments rest are well known from the far-reaching studies of the effects of fleeting visual stimuli and from observations of afterimages. The necessary starting point for the entire experiment is Helmholtz's finding that visual formations which are not fully and consciously perceived during the original excitation will be developed in positive afterimages. From here on a comfortable path leads through the hypnagogic development of visual situations that have penetrated [the mind] preconsciously, known since Purkinje, to those phenomena which have been known and studied as subjective visual phenomena (Johannes Müller) and whose significance was already recognized by Leonardo da Vinci and Goethe. The delayed visual development of preconsciously perceived impressions in the form of subjective apperceptive images plays an important role in the many significant experiments of Urbantschitsch (1907), as does the catalytic effect of other contributing factors which Urbantschitsch considers only in so far as they are relevant to the problem he is concerned with, namely, the mutual facilitation of the different sensory regions. Urbantschitsch's experiments also show the considerable delays in this development, as well as its periodicity, which is similar to that of the afterimage. In my earlier work on experimental hallucinations (1913) I found most of the elisions, displacements, fragmentations into part impressions, inversions in the apperceptive image, etc., that Urbantschitsch described. In my opinion, the technique I used re-examined and confirmed Urbantschitsch's main results under more favorable conditions, and free of any possible subjective admixtures from the subject (see Semon, 1909, p. 80). The delayed delivery of ideas, the manifestation of the preconsciously perceived material in associations with multiple meanings, the fragmentation of the picture exposed and the exclusion of parts of it, the displacements, etc., are familiar from the tachistoscopic experiments of many authors. All of these have helped me, in the past, to demonstrate the identity of the errors made in agnosia and in the perception of tachistoscopic exposures (see Pötzl, 1913). Urbantschitsch's results establish that in audition essentially the same processes take place. Finally, Poppelreuter has used the tachistoscopic method, independent of my experiments with hallucinations aroused by tachistoscopic exposures, to show how the simultaneous perceptual experience is transformed into successiveness in the mind (see Poppelreuter, 1915).

Nevertheless, I feel that as a whole these experiments are new in their setup and in their results, that the novelty lies not only in the demonstration that these processes play a role in dreams, and that the experiments may explain much of the well-known inertia characteristic of visual reactions, which would lead away from such schematically constructed mental elements as "simple sensations" and toward an empirical psychology. The interplay of the slow waves of afterimage development, at long irregular intervals, with the states of consciousness which accompany fluctuations of the depth of sleep, connects Wundt's sensoriphysiological theory of the dream with the above-described results obtained by tachistoscopic methods. At this point my experiments connect with and complement the results of experiments by Maury, Weygandt, Mourly Vold[9] and others, which deal mainly with the penetration of the sleep barrier by excitations which occur during sleep. Experiments to be reported in the future will illustrate the mutual catalytic action between and attunement of such current and memorial excitations during sleep. Here too these results are a link between the various sensoriphysiological theories of the dream. They clarify the validity but also the limitations of each of these theories, and unite them with Freud's theory of the dream into a more general conception.

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[9] For bibliography see Freud (1900, Chapter I).

In the discussion so far, the reactions and the results of the prior experiments have been related to each other in only a generalizing and connecting way. But I wish to stress the importance of one result, which concerns the mechanism of the process itself, and which was obtained and could be obtained only in these experiments. I have tested the validity of this result not only on all the obvious but also on all the merely possible correspondences between the dream image and the slide. I found that there exists a relationship of exclusion, owing to which whatever has been mentally formed as a Gestalt is excluded from subsequent development, so that only parts of the original excitation can develop and whatever has developed into a Gestalt loses the power to act further. The same relationship of exclusion forced the delayed developments which appeared in waking consciousness back toward the original excitational complex, and divided waking and dream, perception and hallucination, into two widely separated realms.

To forestall objections based on misunderstanding I should stress that this relation of exclusion was demonstrated for experimental dreams and hallucinations only in the case of the total effect of one presentation of a single excitational complex. This relationship does not so far apply to the phenomenon of perseveration and stereotypy present in many hallucinations and dreams, especially in psychoneuroses. But if we apply what we have learned in the experiments about the simple case to serial processes, we will understand that the phenomenon necessarily arises. Here we want to note only that [the concept of] this mechanism generalizes Breuer's [concept of] catharsis to the more common and simpler types of excitations, just as the [proposition concerning the] tendency of all inhibited acts toward integration generalizes and supplements Freud's theory of wish fulfillment.

This relationship of exclusion could no more be revealed by the experiments of the authors cited than it could ever have been entirely demonstrated by an analysis of ordinary day residues in dreams. None of these approaches ensured that the preconsciously perceived elements would enter the experiment strictly enough separated from consciously perceived elements, nor that the impressions of the original excitation would be removed immediately. Moreover, the validity of the relationship of exclusion clearly manifests itself only when complex exposures are used. The ordinary dream and ordinary afterimages show the reason why the strict validity of the relationship of exclusion will otherwise be reduced to a mere tendency. This reason has already been discussed earlier. If the access of waking impressions to dream or hallucination is proportional to the degree that they have faded, in other words, to their loss of attention, then every drop of attention should facilitate the access of the persisting impression, since of course from the point of view of its persisting psychic effect, it does not remain the same impression but rather a sum of a multitude of different single excitations. It is thus that positive afterimages are ordinarily elicited by long fixation. In comparing tachistoscopic and continuous impressions as to their afterimages, it is in principle easy to establish that in the former it is always the overlooked details which appear in the afterimage, while in the latter what appear are those parts of the figure which were not charged with attention at the time of exposure, and when there is a general lowering of attention this may be the entire figure. This can be tested only by experimenting on one's self, and requires exact and unbiased self-observation. Cases of general visual disturbance following occipital shot wounds, in which the usual continuous perception itself changes into discontinuous perception owing to periodic fluctuations of attention, are very suitable for the study of the relationship between the curve of attention and the course of perception. We know this from watching a weak source of light in a dark room. The afterimages which come into play here are, so to speak, the precursors in the waking state of the subsequent dream scenes. Occasionally they can be easily observed, when the degree of visual disturbance is just right.

Now it is just this relationship of exclusion which, in conjunction with two other relations, allows a simple theoretical treatment of the findings of this experiment. The other two relations are derived from my experiments on patients with visual agnosia and from the study of three cases of metamorphopsia resulting from injury to the visual region. To conclude this communication I will once more summarize these three relationships.

1. The percepts of indirect vision, the errors of normal people in perception of tachistoscopic exposures, the visual dream images

and the visual errors of agnosic patients, have many essential characteristics of form and content in common. That they all lack a firm spatial anchorage is particularly striking. But their commonalities do not stop here, and common features are ubiquitous.

If the agnosia affects only certain visual qualities, colors or spatial-visual relations, for instance, the absence of spatial anchorage and with it the disturbance of spatial projection which manifests itself in acts of grasping, are also limited to this particular quality.[10] Thus the agnosic patient reacts to continuous exposures in the same way that the normal person reacts to stimuli of an all-too-short duration, to stimuli perceived when his attention is lowered, or to preconscious impressions derived from indirect vision. It may be said, therefore, that the loss of the relevant cerebral region and the corresponding components of the corpus callosum has, within the limits indicated, the same mental effects as the shortening of the exposure time. The similarity also exists between the agnosic reaction and dream images: the mental effect of the gross change in the spatial distribution of excitation in the brain referred to is directly comparable to the mental effect of a condition characterized by motor blocking.

These relationships are not reversible. For instance, a mild, almost compensated color agnosia and word blindness could not be changed into a more severe disorder of the same kind by shortening the reaction time to $1/100$ second.[11]

These relationships[12] contain a space-time transformation. What sort of space is involved remains to be seen. The validity of these transformations in gross changes of the functions described, but only for those, has been established.

2. The nature of the visual residues in relative scotoma, spatial-visual agnosia, directed metamorphopsia in specifically oriented visual and visual-motor defects due to cerebral lesion, and finally the investigation of dream images which stem from the aftereffects of preconscious visual impressions, all show that, under certain,

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[10] Except when a general projection disturbance of grasping exists independent of the visual agnosia. This rarely coincides clinically with the condition described here, however.

[11] This refers to my observations of one case (Schäfer) which will be extensively discussed elsewhere.

[12] Let us assume for the time being that this applies only to Liepmann's focal type: left cerebral, mainly subcortical, focus in the right-handed person, where the focus interrupts the adjacent part of the corpus callosum.

partly controllable, conditions, there exist reversible transformations of eye movements and incipient eye movements into perceptions of movement and perceptions of form and space. Therefore we can directly demonstrate the motoric origin of a group of visual phenomena; within certain limits, we may speak of a visual-motor transformation, in the sense that it is the blocking of the movement that causes space and form-quality to appear in the mind.[13]

Within due limitations, this relationship makes it possible, at least in principle, to set up analytic propositions about the mechanics of these phenomena, whose dimensions are so far unknown, without these propositions being limited, like Fechner's law, to the comparison of several intensities of identical stimuli and sensations. Phenomena whose psychological qualities are experienced as basically different from each other can be transformed into one another, and thus can be regarded as manifestations of a common underlying process, which would justify measuring them on a single common scale [. . .].

3. We find a relationship of exclusion according to which the parts of a visual situation which have attained form have no further effect, while the parts which have not attained form, that is, those which have been preconsciously perceived, continue to exert an effect. If the perceived [material] is at a maximum, the latent elements, which exert their persisting effects in the preconscious, are at a minimum, and vice versa [. . .].

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[13] This visual-motor transformation is connected with physiological conditions, according to the findings and views of Sachs, and Sachs and Meller (see Sachs and Meller, 1903-04). This is the physiological finding which fully clarifies the metamorphopsia and the diplopia in my focal-cerebral cases.

2

ON THE UTILIZATION OF UNNOTICED IMPRESSIONS IN ASSOCIATIONS

RUDOLF ALLERS AND JAKOB TELER

Although it has often been stressed that our mental life is by no means limited to the states and processes which we can express verbally, we nevertheless cling to words from force of habit. Perhaps we do so because we can more or less adequately describe or circumscribe in words such states and processes, or perhaps because they are processes which take place in or through the medium of words. Consider, for instance, the usual association experiment; we determine the reaction word, the reaction time, and sometimes other reactions, such as breathing, circulation, psychogalvanic response. In general, however, we do not pay attention to everything that takes place during the reaction time.

In postulating "transitive states" and the concept of "fringe," William James was the first to state explicitly that there are mental phenomena other than words or those designated by words. James did not, however, attempt to describe or classify the mental processes that occur in the "fringes." The first investigations to clarify these phenomena stemmed from the research begun by Külpe. The discovery of mental phenomena of the "states of consciousness"[1] type, the clarification of the ways of experiencing "tasks,"[2] etc., initiated a period of growing interest in the "transitive" elements of

[1] [*Bewusstseinslagen.—Tr.*]

[2] [*Aufgaben.—Tr.*]

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consciousness. But in spite of numerous studies in this field and the insights they have yielded, our knowledge is still very sketchy.

When an investigator succeeds in pinning down and naming a nuance, or a particular kind, of such fleeting and imageless experiences, the existence and character of that experience often become generally recognized, are confirmed by others, and sooner or later this new knowledge becomes the common property of psychology. This was the case with Bühler's "thoughts,"[3] with Marbe's "states of consciousness," and with the components of volitional actions which Ach was the first to try to define. Many such fleeting processes escape our observation because *we have no name for them,* and cannot establish their presence or make it plausible to other people. As we learn more about these still unnamed mental elements, the realm of the "unconscious" will diminish, as will the reason for constructing mental connections by assuming that the course of mental processes is to submerge into and re-emerge from the "subconscious."

To capture such experiences is unquestionably a difficult task, requiring introspective skill, practice, and judgment. But it may be possible to prove their presence by indirect means. We have made certain observations which seem to do just that.

Not infrequently we experience the apparently spontaneous appearance of images and imagelike phenomena which we do not identify as memories, but which we can, nevertheless, sometimes prove to be reproductions. We asked ourselves whether something that is "not noticed" can intrude into the conscious processes, and whether such an intrusion can be demonstrated.

Pötzl (1917) has demonstrated intrusions of this sort in dreams.[4] Since it has always seemed to us unjustified to draw a sharp distinction between dream consciousness and waking consciousness, we had no doubt that similar phenomena occur in the waking state as well.

The past experiences and experiments of one of us (A.) gave us the hope that unnoticed stimuli or parts of stimuli can intrude into the imagery which often intervenes between the stimulus and the reaction word [in an association test]. To test this expectation we devised the following procedure.

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[3] [*Gedanken.—Tr.*]

[4] See this monograph, pp. 41-120.

METHOD

The subjects were shown tachistoscopically projected slides. The exposure time was ⁴⁄₁₀₀ sec.; this length—Pötzl used ¹⁄₁₀₀—was chosen to insure that unnoticed stimuli, should they be reproduced, would be sufficiently clear. Our aim was to prove conclusively that unnoticed parts of the slides would emerge in the subject's images, or "representations,"[1] as Allers once called them, and therefore we wished these parts to be relatively definite. We hoped to achieve this by lengthening the exposure time, and the experiments seem to have justified this hope. The diameter of the field of projection was approximately 4½ feet, and was easily taken in at a glance by the subject, who sat about 6 feet from the projection screen.

The experiments were carried out with eight subjects: here we will report the results of five of these. Subject I was shown a slide of Titian's *The Presentation of Mary* (from the Academia delle belle Arti in Venice). The other four subjects to be reported on were shown a slide of a village street. Instead of reproductions of the originals, we give sketches of them (Figs. 1 and 2). The subjects were of course not familiar with the pictures.

In order to familiarize the subjects with the situation, the main experiments were preceded by several preliminary trials. These trials occasionally had some influence, certain parts of the pictures understandably intruding into the main experiments. But no [other] interference was observed.

The subjects were instructed to notice as much as they possibly could, to record their impressions immediately after the exposure, and to sketch what they had seen as well as they could.

On the next day, an association test was given, timed with a ⅕ second stop watch. The instructions were, as usual, to react immediately with the fisrt word that came to mind. The subject was also asked to note what occurred to him between stimulus and reaction word, and to record it immediately after the response. Here too we asked the subject to draw what he had seen. We had records of previous association tests of Subjects II and III, and these clearly showed that the additional instructions did not prolong their reaction times, and probably not the others' either. When the experiment could not be completed in one day, it was continued on the next. This did not affect the results.

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[1] [*Darstellungen.*—*Tr.*]

With the exception of Subject II, the subjects were unaware of the purpose of the experiments; they did not know at the time of the exposure that an association test was to follow, nor during the association test what the purpose of it was. Nevertheless, they adopted a certain set[2] (see pp. 144-145).

The stimulus words were chosen so that, interspersed between quite neutral ones, were words referring to the parts of the slide which the subject had not mentioned in his first description. Since the originally unnoticed parts which emerged in the form of "representations" following certain stimulus words were not recognized by the subjects as recollections of the slide, we were satisfied that the unnoticed elements of the slide did not emerge as spontaneous recollections.

After the association test, the slide was projected again, not tachistoscopically of course, and the subject was asked to compare the picture with his memory of his "representations." We had, of course, chosen subjects whose type of visual imagery we knew.

In the following records of the experiments, we have included only the associations which supplement the original impression with "representations" containing originally unnoticed elements. In the interests of brevity, we shall call these "supplementing" associations. It would be desirable to reproduce all the sketches the subjects made of these "supplementing representations," but nowadays this cannot be done.[3] We will present instead a sketch which combines the original impression and the elements added by the "supplementing representations," labeling the latter with the numbers of the corresponding associations. For obvious reasons we present composite sketches for only two subjects (II and III). Since Subject I was familiar with the *Village Street,* we had to show him a different slide. It seemed superfluous to reproduce *The Presentation of Mary,* since it can be found in books on the history of art or on Venice.[4] Figure 2 is a sketch of the slide *Village Street.*

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[2] [*Einstellung.—Tr.*]

[3] [A reference to the economic conditions in Germany after World War I.—*Tr.*]

[4] [A drawing of *The Presentation of Mary* has been provided for this translation (Fig. 1).—*Tr.*]

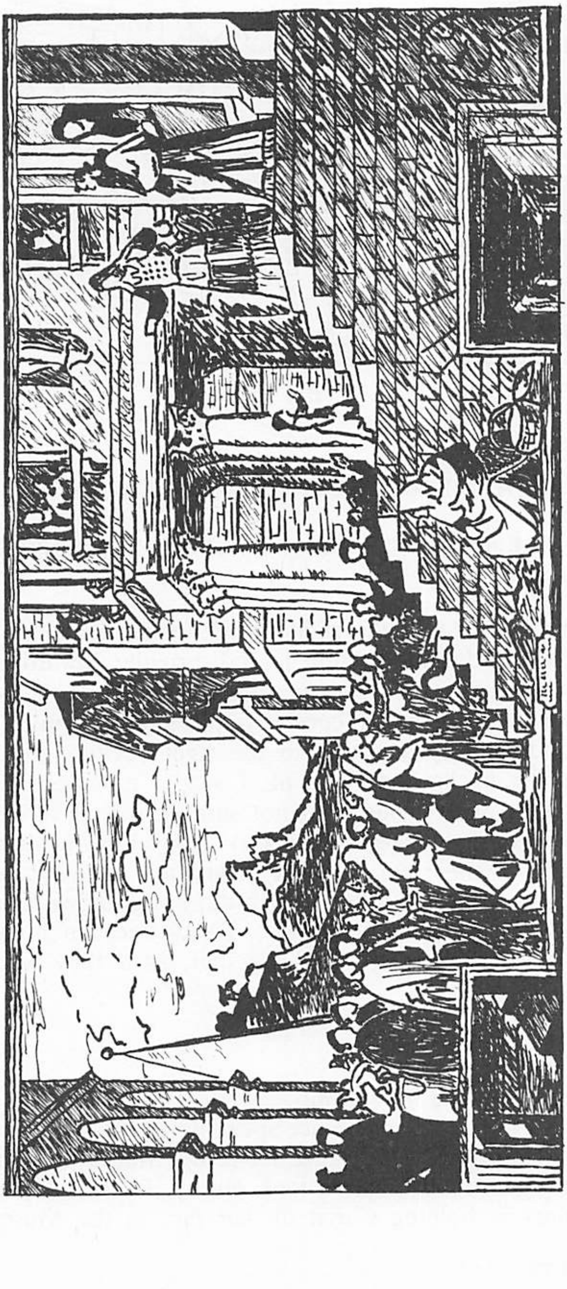

Fig. 1

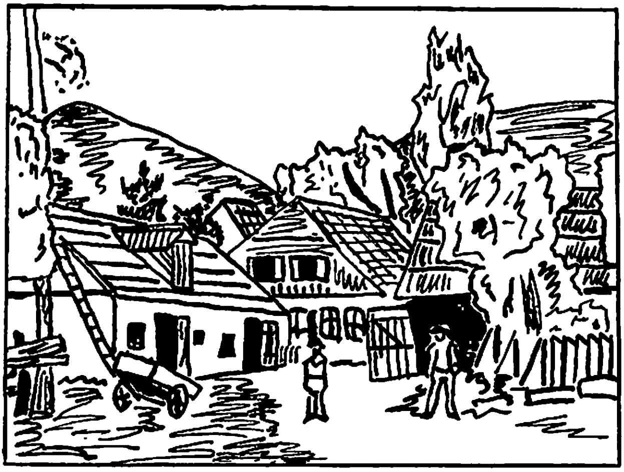

Fig. 2

THE RECORDS OF THE EXPERIMENTS

SUBJECT I: REPORT ON THE TACHISTOSCOPIC EXPOSURE (*The Presentation of Mary*)

Nothing at first. To the right a cliff, rather long, partly angular and partly rounded at the top, jagged, broader toward the bottom, trees near it, and next to them something like a valley spreading downward. If I remember correctly, the sky was blue, with fleecy clouds. I didn't see anything to the right because of the reddish rings. In the background I think I saw a mountain which came down into the valley, but I am not sure. It was as if the mountain were covered with trees. (Thinks.) Now I remember better: I saw a cliff on the right; it went down into a valley, and that in turn merged with a mountain, which did not go down again but was cut off by the edge of the picture. I saw trees on both cliffs; the trees on the left were crowded together, as if they were towering over one another.

Associations

7. Beard-Winnig,[1] 6 seconds.

A memory of an acquaintance speaking about a beard; and at the same time an image of Entrance III of the Market-Hall in Budapest (near which this conversation took place). I saw a *Pieta,* the scene where Mary is holding Christ on her lap, in the Museum of Art

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[1] [Proper name.—*Tr.*]

History in Vienna. Mary is wearing a long dress which reaches the ground. The lower part of Christ's body is covered. (Thinks.) Now I remember that I had a dream. I didn't realize it this morning. Now I remember that I dreamed I saw a man and a woman near the cliff. The man had a stick. A number of things come to mind now, but I am not sure if I dreamed them or not. Here (pointing to the right side of the screen), next to the cliff, I saw a small church spire and next to it some very small houses like a village, blue sky overhead. But I am not sure about any of this.

8. Window-Danube, 3 seconds.

I was on an excursion boat in Budapest; I saw the Parliament building with the steps, and a few people around; but now I also think of an excursion with friends. I put my head out of the window of the excursion boat.

28. Colonnade-Museum, 4 seconds.

I don't know where it was; at first I saw a colonnade of four columns topped by a triangle, and with steps leading to it. Now it occurs to me that the National Museum in Budapest looks like that. The images are coming slowly: Pallas Athene in the center of the triangle, Romans all around; then I see the museum garden, the fence, etc.

Second Exposure

The subject recognizes the spire, the trees, the clouds; he saw the figures as trees. Only the two figures in the foreground and the steps seem familiar to him. He realizes that he mistook the buildings for cliffs. He thinks he also recognizes the basket in the foreground. He recognizes the inscription and believes that it is related to the III of the Market-Hall in Budapest, which he mentioned in his report. The outstretched arm of one of the figures he took to be and reported as a stick. Asked what the Mary whom he described in his report looked like, whether she was sitting or standing, the subject replies: "I saw her sitting, just the way she is in the picture." Then he adds (spontaneously): "Doesn't the seated Mary have some connection with the seated old woman in the slide?"

SUBJECT II: REPORT ON THE TACHISTOSCOPIC EXPOSURE (*Village Street*)

Village street, rather unclear, from the left foreground to the right rear. The left side of the street consists of two houses; have only one story. The first house in side view, with a pointed gable, maybe a window on the narrow side. The front has two or three windows and a door. The second house like it. To the right, another house, vaguely, really only a wall. Something dark in the background:

a clump of trees. In the street, about at the first house, something dark, like a stooped human figure, walking toward the viewer.

Associations

4. Stone-Cliff, 1 second.

The village street. A large stone on the left side, roughly in front of the near corner of the first house. The gate with the cliffs as posts from the other slide (preliminary experiment) goes across the village street, with a steep cliff on the right and a tree or a cross or something.

7. Wagon-Ride, 1 second.

The village street again. On it a hay wagon,[2] which doesn't seem to have any horses. Somehow in front of it the stooped figure from the picture. Didn't see the shaft. Not sure of the position of the wagon. Didn't see the right side of the picture, and I'm not sure of the exact location of the wagon and the figure; just on the street.

9. Roof-Floor,[3] 2 seconds.

The first house. The gable starts at a wide angle and gets higher and more pointed as it goes up. At first saw only the side of the house, but now the continuation of the roof backwards; its ridgepole doesn't seem straight any more but somehow serrated, as if made of shingles, bricks, or bundles of thatch. There is also the vague shape of a chimney, and the memory of similar houses in Galicia.[4] The chimney roughly in the middle of the roof.

12. Peasant-Tree, 2⅖ seconds.

At the first syllable (*Bau*)[5] I got the picture of trees in the background, but more detailed and more clearly defined. Two or three trees. The one on the left has a light, forked trunk. Then realized that the word was "peasant," and for an instant saw the figure in the foreground. I thought, "tree" doesn't fit at all, but no other word [came to mind]; the figure disappeared again, the trees stayed, so said "tree."

15. Background-Foreground, 1 second.

The trees again. At first came the imageless thought *repoussoir*,[6] and a fleeting memory of Wölfflin (*Grundgesetze der Malerei*); then, while the trees remain in focus, something dark, like the shadow of a triangular form, moves forward from the right forward edge of the picture—which is just as unclear as the left part of the picture—so that now the street seems considerably lighter between the dark trees and this triangular shadow. It is not clear, and simultaneously arouses a feeling of doubt, whether this darkness lies on the street like a shadow or stands on it like an object. After the response, the thought that when the sun shines on the houses to the left, the house to the right must cast a shadow.

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[2] [*Leiterwagen:* literally, "ladder-wagon," a wagon with slatted sides.—*Tr.*]

[3] [*Dach* (roof) and *Boden* (floor) combined as *Dachboden* = "attic."—*Tr.*]

[4] [Southern Poland, part of the Austro-Hungarian Empire before World War I.—*Tr.*]

[5] [*Bauer* = "peasant," *Baum* = "tree."—*Tr.*]

[6] [French for "contrast" (in painting).—*Tr.*]

16. Head-Legs, 1 second.

First the memory of a case of hydrocephalus I heard about; then the figure, this time obviously walking; the upper part of his body is unclear. The first house is the background. The figure is standing closer to the house than before.

18. Brick-Stone, 1 second.

First I saw a single red brick; then on the upper part of the first house the brick wall through white plaster, or perhaps it had fallen off in places. After I gave the response I saw the house again, and a pile of bricks lying about where the stone was (in association 4).

19. Barn-Gate, 1 second.

First I saw a barn in Aussee; then suddenly the right side of the picture appeared and the shapeless dark mass seems to be the long side of a barn built out of boards and posts, with spaces in between.

20. Yard-Moon, 1⅖ seconds.

The picture approximately as described the first time. Somehow inserted into it or on top of it the blurred picture of a farmyard, of which actually only the ground with stones and grass between are clear, and a hay wagon, standing not quite in side view but with the shaft pointing forward. The hay wagon is standing toward the left. I can't place it more exactly. The word "moon" without any image.

21. Open-Shut, ⅗ seconds.

The barn seen before has an open gate in its front third, perhaps with one gate wing protruding into the street.

22. Tree-Forest, 1⅖ seconds.

The trees in the background as described before (forked), and a dark surface which looks like a wooded hill in the upper right corner of the picture.

24. Fence-Stick, ⅘ second.

On the right side of the picture, next to the barn, a stretch of fence appears for an instant, and immediately disappears, giving way to a familiar fence. A vague picture of a wall further to the right, behind the fence. A kind of front garden behind the fence. A wall behind the front garden.

26. Branch-Tree, 1 second.

The trees with forked trunks in the background. A branch is sticking out on the left side of the tree, and is swaying in the wind.

28. Run-Walk, ⅖ second.

The figure in the same stooped position, but the legs seem to be far apart. The light background is visible between them.

29. Wheel-Break, 1 second.

The hay wagon on the village street, in front of the house on the left; the right wheel is clear from the viewer's position. Everything disappears except the wheel, which grows large and breaks into two pieces.

34. Chimney-Smoke, 1 second.

The first house, with the chimney already described standing in the back half of the roof. No smoke coming from it.

35. Peek[7]-Look, 1 second.

The first house has an attic window on the narrow side. The thought that something could peek out there, a cat, for instance. An actual memory.

36. Leaves-Trees, ⅖ second.

The trees in the background, very vaguely. Then the fence and front garden (of association 24). There seem to be large plants or bushes in the front garden, perhaps sunflowers.

37. Boy-Girl, 1 second.

First the Brahms song, *Von ewiger Liebe*. Then, roughly at the gap between the two houses on the village street, a colorfully dressed woman, in profile, in a white striped skirt and a yellow kerchief, perhaps the costume of a Slovakian or Moravian peasant woman. Her face is to the left. The whole figure very small. Memory of a picture by Orlik.

42. Ladder-Wagon, ⅖ second.

First a ladder leaning against the first house. Then the hay wagon with its long side clearly visible; it is always empty.

43. Gate-Barn, ⅖ second.

The barn with the open gate and protruding gate wing.

47. Windowframe-Wing, ⅗ second.

A window on the side of the first house; its right wing (from the observer's viewpoint) is open; seems to be divided horizontally.

48. Grass-Stones, ⅘ second.

The ground with stones and grass again. The impression that in the lower left corner of the picture, left of the first house, the beginning of a meadow, which is cut off by the edge of the picture.

Second Exposure

All the details of the picture are recognized. The originally unnoticed elements, which emerged in the "representations" during the association experiment, are identified without hesitation. The striking correspondence between the parts seen during the association experiment and the actual picture is noticed with considerable surprise.

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[7] [*Herauslugen:* literally, "to peek out."—*Tr.*]

SUBJECT III: REPORT ON THE TACHISTOSCOPIC EXPOSURE (*Village Street*)

Impression of a sunlit village scene. I could not describe the details.

Associations

1. Stand-Walk, 1 second.

I saw a man standing, then he began to move.

24. Fence-Tree, ⅘ second.

I saw a large garden, with a wooden fence.

26. Machine-House, ⅖ second.

I saw a barn, with a threshing machine in it, close to a farm; a dark building with a thatched roof. Gate wing open. Chiefly the barn, and further away neighboring farmhouses.

29. Wheel-Spoke, ⅖ second.

Saw a hay wagon with all its wheels.

34. Chimney-Flue, ⅗ second.

Saw a chimney on a farmhouse. A white house with a very overhanging roof. Saw just the house, small windows, and a narrow door.

42. Ladder-Stick,[8] ⅖ second.

I don't know why I said stick. I saw a ladder leaning against a farmhouse, to the attic.

43. Gate-Door, ⅖ second.

Saw a farmhouse with a large gate, and the door in the gate open.

61. Open-Door, ⅕ second.

Saw the flagstone floor of the hallway through an open door in a farmhouse.

Second Exposure

The subject recognizes all the details of the picture: the windows, ladder, peasant, house and roof, doors, barn. Although the subject cannot remember having seen all this in the first exposure, he nevertheless recognizes the details, and explains this by suggesting that he probably saw them without being aware of doing so. His reaction to the stimulus word "machine" was "barn"; there really is something like a machine in the barn, and he recognizes it.

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[8] [*Stock;* another meaning of the word, which would be relevant in this context, is "story" (of a building).—*Tr.*]

SUBJECT IV: REPORT ON THE TACHISTOSCOPIC EXPOSURE (*Village Street*)

Saw a landscape in broad daylight, with houses and a few people.

Associations

4. Stone-Ibex,[9] 1 second.

Saw ibexes. Afterwards it came to me that the people I saw in the picture yesterday were standing on stony ground.

7. Wagon-Wheel, ⅘ second.

I saw a wagon, especially a wheel; a wood-carrier's wagon, without horses or driver; grass in the background, in mountainous country, on a road in the side of the mountain.

12. Peasant-Festive, 2⅕ seconds.

A festively dressed peasant with a black hat, suit, and boots, standing on a village street. I saw something like this in Balatonbereny.

29. Wheel-Wagon, 1⅘ seconds.

I saw the same wagon I sketched before.

42. Ladder-Rungs, 1 second.

The rungs of a ladder, which I saw leaning against an attic, came to mind.

SUBJECT V: REPORT ON THE TACHISTOSCOPIC EXPOSURE (*Village Street*)

Directly in front of me a small white house with three or four windows. A door, an entrance, in the middle; a gabled roof, high and steep. Then to the right of it a somewhat higher house, on the whole darker than the first. A man with a moustache in front of the nearer, smaller house. A street or square.

A few hours later the subject spontaneously said that it seemed to him that there was an oxcart or something of the sort near the man.

Associations

4. Attic-Gable, 2⅖ seconds.

I saw the attic of a house with a steep gable.

6. Mount-Climb, 1⅖ seconds.

This house is pursuing me. I saw a man climbing to the roof of it on a ladder.

7. Wagon-Ride, 1 second.

I saw a wagon, parallel to the two houses, but the oxen were turned away from me, pulling the wagon from the small house to the large one.

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[9] [*Stein-Steinbock.—Tr.*]

9. Roof-Triangle, 3 seconds.

A triangular roof; it's on the same house.

12. Peasant-Wagon, 3 seconds.

I see a hay wagon, loaded with grain, and to the left of it, walking, a peasant in a white shirt and a black felt hat. I see two different peasant figures. First he has a white shirt, a coat over it, a hat with a wide brim, and a moustache, and then I see an old man with a pipe in his mouth. These alternate, one disappearing, the other emerging. Now I see them side by side. This is all in a village.

15. Background-Dr. Damask, 2 seconds.

The image of a man with graying hair appears; Dr. Damask has gray hair. All this appears and then slips into the background. Then the image of a tree-lined road, foreshortened; tall trees; large crowns in front, toward the back everything is foreshortened.

18. Brick-Red, 1 second.

First I thought of red; then I saw a whitewashed wall, without any spots.

19. Barn-House, 4 seconds.

I see the house (the larger one) emerging in front of me, and then thatch-covered gray barns behind and to the right of it.

20. Yard-High, 1⅗ seconds.

I see the barns in the yard of this house. A yard behind the higher house. Later I see children playing.

24. Fence-Branch, 2 seconds.

Saw the picture of a fence, made out of branches, not boards; it was in front of the tree-lined road, at the beginning of a farm.

34. Chimney-House, 1 second.

A small chimney made of red bricks. It fits into the right side of the small house, where it touches the larger one.

37. Boy-White, 2 seconds.

Saw a young boy running; he was wearing a white shirt.

42. Ladder-House, 1 second.

Saw a ladder leaning against a house, as sketched (leaning against the smaller house to the left).

43. Gate-Gray, 2 seconds.

The door of the small house, contrasting with the white color of the house, but not gray.

Second Exposure

The subject recognizes all the details of the picture, the peasants, the wagon, even the peasant with the pipe in his mouth, the little girl, the trees, which are recognized as being related to the "representation" "tree-lined road." He took the house in back to be a barn. He recognizes the windows of the large house.

The overhanging roof of the small house. The chimney on the small house is recognized (with the greatest surprise over the correspondence to the record) at the very place where it was located in the association: to the right, next to the larger house.

RESULTS OF THE EXPERIMENTS

On the strength of the records presented here, we believe we may conclude that components not present in the subjects' initial impressions of the picture appeared in the "representations" elicited by appropriate stimulus words.

In the associations of Subject I, a figure from a *Pieta* in a Viennese gallery appears in association 7. Later on we searched the gallery with the subject to find this picture; he identified it as a *Pieta* by Rubens. At the time of the experiment it did not even occur to him that a figure in the slide could have any connection with this memory, since the slide seemed to him to be a landscape. At the second exposure, however, the subject mentioned spontaneously that the contours of the woman sitting in the foreground, under the steps which the young Mary is ascending, reminded him of that picture; and just as spontaneously it occurred to him that the figure in the Titian might have had something to do with the emergence of this memory. Now there is, as a matter of fact, a certain resemblance between the contours of the seated beggar woman in *The Presentation* and the mourning Mary in Rubens's *Pieta*. Both women are wearing a cloth which covers the head and shoulders, and the shoulder line is strongly accented in both. The subject's comments while looking at the *Pieta* are of great interest: they involve a curious error of memory, in that the seated Mary wore a white cloth around her head and shoulders in the [subject's] memory, whereas in the painting the whole figure is covered with a dark cloth; but the seated beggar woman in *The Presentation* is actually wearing a light cloth which covers her head and shoulders. We believe that this too indicates—perhaps proves—that the subject's memory of the *Pieta* was determined by the figure of the beggar woman, unnoticed during the tachistoscopic exposure. The sketches reproduced in Figure 3 give an idea of the two female figures. We believe that there is an unmistakable relationship between the contours.

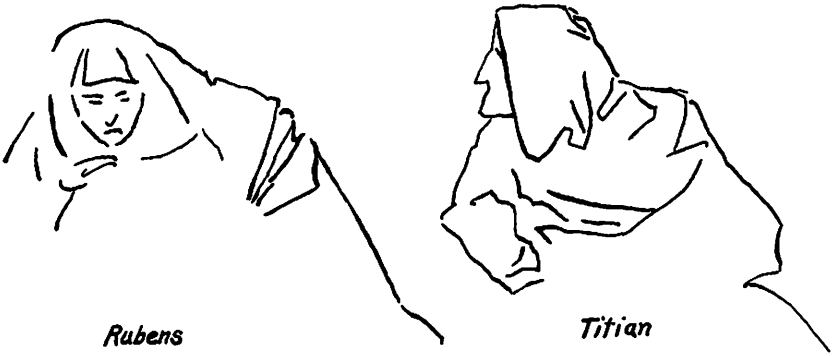

Fig. 3

Similarly, the man with a stick, seen in the same association, was also identified by the subject, at the second exposure, with a figure in the picture.[1] The record of the association test has "a woman and a man with a stick, near the cliff," and there are in actuality two figures standing on the lowest step of the stairs at the foot of the rocky mountain which is glimpsed as the background between the buildings; in front is a woman dressed in light colors, and behind her one in dark clothes, pointing with outstretched arm at the young Mary. The subject recognized the outstretched arm as the stick and the two women as the figures in the "representation."

We will not venture to decide whether the stairs of the Budapest Parliament in association 8 are related to the steps in *The Presentation*. There seems to be a clearer connection in association 28, but even here we cannot be certain. However, the Museum in Budapest does have steps which, like the temple steps in the Titian, are broken by a landing and lead to a colonnade or portico. This connection is therefore quite probable, even if it cannot be definitely asserted.

On the other hand, the small church spire (association 8) next to the cliff, under the blue sky, can certainly be identified with the pointed obelisk, topped by a metal ball, which stands out against the sky, close to the mountains, in the Titian. It might be that the small houses, which looked to the subject "like a village" next to the church steeple, are somehow related to the buildings in the picture. But it is equally possible that the houses appeared simply as a meaningful completion of the small church steeple, seen as belonging to a village church.

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[1] In the record this man appears as a memory from a dream. That this memory (if the subject's report is correct) should appear with just this association seems to point to an intrinsic relationship.

Let us now examine the report of Subject II, which is illustrated in Figure 4 according to the method outlined above. Here the memory of the picture is prominent all the way through. This should not, however, be ascribed to the fact that the subject knew the aim of the experiment, because the same thing happened with the next subject, although he knew nothing about the experiment.

The large stone, seen in association 4, may come either from a dark place in the picture, or from a pile of stones lying by the telegraph pole somewhat further back. Association 7 is more interesting. The subject sees a hay wagon without horses and without shaft in the village street, at the very spot—as Figure 4 shows—where in the picture there is actually a wagon whose shaft is not visible. We shall not try to decide whether the ladder—another of the unnoticed details—also contributed to the appearance of the hay wagon.[2] This is not improbable, since the hay wagon also appears in the reports of other subjects.

In association 9, the articulation of the roof, which originally appeared to be smooth and uniform, can easily be related to the

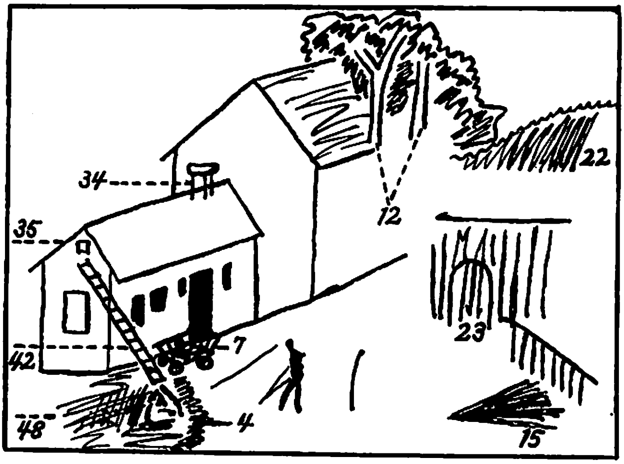

Fig. 4

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[2] [See footnote 2, p. 128.—*Tr.*]

actually visible shingle roofing. Similarly, there may be a connection between the flue and the actual components of the picture. The fact that the flue is placed in the middle of the roof in the "representation," while it is toward the rear in the picture, could be due to the interruption of the ridgepole by the protruding door of the hayloft.[3]

There can be no doubt about the relationship between the light forked tree trunks which appeared in association 12, and the birches in the background of the picture which branch over the roof of the second house.

The roughly triangular shadow in association 15 corresponds to a triangular dark spot, formed by shrubs and grass, on the right side of the picture, and coming to a point toward the middle.

The description of the human figure as clearly walking, in association 16, corresponds to the fact that in the picture the street can be seen between the legs of both male figures.

In association 18 the stimulus word "brick" arouses the impression that the plaster on the house has come off and the bricks are showing through. It is possible that this impression comes from the division of the side of the first house into a white wall and a dark upper part made of boards, a contrast not observed at the time of the exposure.

The effect of an unnoticed part of the picture seems especially clear in association 19, where a shapeless dark mass develops into a barn, in accordance with the picture; the gaps between the boards and posts may well be related to the board fence in front of the barn.

Association 20, although interesting in other respects, contributes no more to our present concern than did association 7.

Association 21 offers a complete reproduction of an unnoticed detail in its precise position (see Fig. 4[4]); but it also shows how loose may be the associative connections which can elicit unnoticed components. There could hardly be a direct connection between the stimulus word "open" and the image of an open barn gate. This association, like 20, also shows a remarkable dissociation between "representation" and verbal response.

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[3] [In the picture, the "protruding door of the hayloft" is what we would describe as a dormer window.—*Tr.*]

[4] [Apparently association 21 has been mislabeled as 23 in Figure 4.—*Tr.*]

In association 22 the emergence of the wooded hill in the rear at the left[5] is also a simple reproduction; so is the appearance of the fence near the front garden in association 24 (note the shrubbery behind the fence in the picture).

The trees with the light forked trunks, mentioned in association 12, return in association 24,[6] perhaps even the branch at the left coming from the picture. The legs of the figure in association 28 are already familiar [16] and are spread apart just as in the picture. In association 29, the connection between the wheel which appears and the three wheels visible in the picture is less clear. The right rear wheel of the cart is the most noticeable, but none of the wheels is in a position which exactly corresponds to the subject's sketch.

The chimney flue of association 9 reappears in association 34, but this time it is correctly placed in the back part of the ridgepole. Similarly, in association 36, the shrubbery behind the fence appears far more clearly and in closer correspondence to the picture than before (association 34[7]). The appearance of the attic window in association 35 is not clear, but could be explained as a transposition of the hayloft entrance which is on the front of the house to the side.

The location of the figure in association 37 corresponds to the picture, but otherwise elements foreign to the picture appear here.

According to the sketch, the position of the ladder in association 42 fully corresponds to its position in the picture; it seems to go up the side of the first house. In the picture it is leaning against the telegraph pole, but the upper part of it disappears so completely in branches that it is easy to be misled, even after lengthy observation.

Association 43 repeats previously seen material. In association 47 the window wing which is open to the right could well be related to the door of the first house whose wing is open to the right, or to the open windows of the house in the rear, one of whose right window wings is especially clear.

In association 48 a meadow appears in the lower left corner, corresponding to an actual plot of grass in that part of the picture.

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[5] [An error for "right."—*Tr.*]

[6] [A misprint of 26.—*Tr.*]

[7] [A misprint of 24.—*Tr.*]

In the associations of Subject III, whose "representations" are in part shown in Figure 5, it is uncertain whether the man who is first standing and then walking is related to the picture. It is not unlikely, since the male figure on the right does give the impression that he is just beginning to walk. Association 24, which produces a wooden fence with a garden behind it, and leads to the reaction word "tree," may also have been determined by the picture.

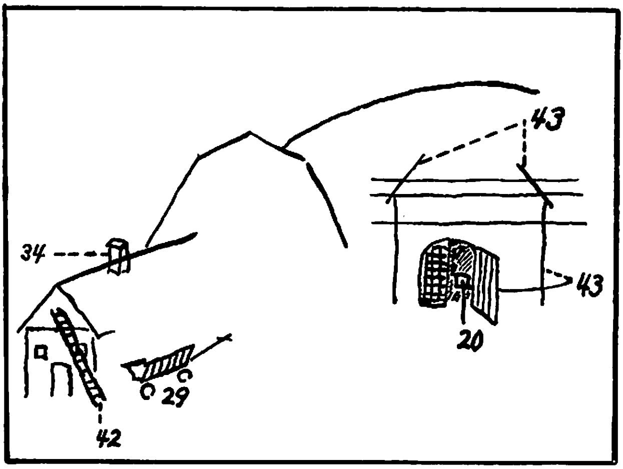

Fig. 5

The relationships between picture and "representation" in association 26[8] (Machine-House, ⅘ second) are striking. A barn is seen with a threshing machine inside; the door is open and the whole situation corresponds to the picture, in which something actually is visible in the barn which could well be considered a machine (although it appears to be a wagon).

In association 29 a hay wagon appears, like the one seen by Subject II. What we said above about the possible influence of the ladder in this applies here too.

Association 34 brings the chimney flue and details of the house not seen originally but recognized at the second exposure. Association 38[9] too probably refers to the figures in the picture. The "representation" of the ladder in association 42 also coincides with the picture, just as in the case of Subject II. Without knowing why, the subject responded to "ladder" with "stick"; it would be incautious to regard the telegraph pole as a factor in this.

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[8] [Apparently mislabeled 20 in Figure 5.—*Tr.*]

[9] [Association 38 is not given in Subject III's record.—*Tr.*]

We cannot say anything about associations 43 and 61, although they seem to refer to the picture, because the references are uncertain.

Concerning Subject IV's record, it should be mentioned first that a farm wagon appears here too, without horses and driver (association 7); whether or not the details of the "representation" —mountain, path—are related to the picture is uncertain. The relation of association 12 to the picture is equally uncertain. The same wagon returns in association 29. In association 42 the subject reported that the rungs of a ladder, leaning against an attic, came to his mind, but in his sketch he first drew part of a stepladder, of the kind used in households. He immediately reported, however, that this was not the ladder he had seen, and made a second sketch, of a ladder like the one in the picture. We cannot be sure whether two "representations" crossed here or whether, in the course of sketching, a second one emerged, which then was corrected. In any case, the shape of the ladder as well as the assertion that it leaned against an attic correspond to the picture.

Finally, the results of the association experiment with Subject V. We will not attach much importance to association 5.[10] Association 6 seems more significant, since here we have a ladder leading to the roof of a house, and according to the sketch it fully corresponds to the one in the picture.

In association 7 an ox-drawn wagon appears. It is noteworthy that the oxen are headed away from the subject, and therefore the wagon is seen from behind, which corresponds to the picture. The position of the wagon is about the same as in the picture.

In association 12 the hay wagon, already familiar from Subjects II and III, turns up again. The surroundings of the hay wagon also correspond quite well to the details of the picture, in that a second figure is now visible to the left, where previously there was only one; the subject even mentions the detail that the man has a pipe in his mouth.

[10] [Perhaps an error for 4. Association 5 is not given in the record.—*Tr.*]

We are probably not mistaken in relating the tree-lined lane of association 15 to the trees in the background of the picture, and the "large crowns in front" to the tree in the right center of the picture (in front of the barn). The foreshortening too may be derived from the depth of the picture, which is clearly emphasized by the sunlit village street. There seems to be an obvious relationship between the picture and the barn (association 19) which appears as gray and thatched, to the right of and behind the larger house. Similarly, we believe that the children playing[11] and the other details connected with association 20 are related to the corresponding parts of the picture.

The report of association 24, which describes the fence made of branches as the beginning of a farmyard, may also be derived from the picture. A relationship is much clearer in association 34, where the chimney, which was not noticed during the exposure, is put in the right place and even its brick construction (as it appears in the enlarged projection) is included. In association 37 the connections are less clear, although here too the fact that the boy is seen in a running position makes the previous comments relevant.[12]

Association 42 (ladder) shows the ladder leaning against the house—we might almost say typically, considering our experience with the other subjects. Association 43 does not call for any special comment.

DISCUSSION

The results of these experiments are: under the influence of suitable stimulus words, pictorial "representations" appear in the interval between stimulus and response word; although not mentioned in the description given by the subject immediately after the exposure, and not recognized either then or thereafter as having been seen earlier, i.e., as having been components of the originally exposed picture, these "representations" are nevertheless elements of the perceptual manifold presented.

On the other hand, it should be pointed out that the fitting of these belatedly emerging elements into the framework of the memory of the exposure does not usually cause any surprise. Occasionally a subject will remark that he "suddenly" sees this or that previously unobserved—or absent—detail, but distinct experiences of astonishment are not reported. Even less frequently is a "quality of familiarity" experienced, in the sense that, as a rule, the new element which fits into the initial framework is not recognized, either during the experience of or report of the "representation," as belonging to the initial exposure, or as ever having been seen before, unless it is derived from a different experience and belongs to that. All this is in good agreement with the fact that at the second exposure of the picture, after the completion of the experiment, all the subjects recognized with varying degrees of surprise the actual presence in the picture of the supplementing components contained in the "representations."

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[11] [Presumably a reference to details which were omitted from the sketch of *Village Street.*—*Tr.*]

[12] Subject II, association 16; Subject III, association 1.

These experiments obviously should be extended in various directions. It would be particularly important to establish whether, by the use of appropriate stimulus words, it is possible to force the addition of components which fit meaningfully into the original picture but are not parts of it. This is to say, it should be determined to what extent the results we obtained could be considered chance effects. We believe, however, that we can dismiss this assumption even before making such experiments. We base this belief on the fact that the supplementing components contained in the "representations" correspond to the picture not only in their nature but frequently in their location as well. It would be a very strange chance indeed if, for instance, the stimulus word "ladder" should regularly elicit a ladder leaning against the house against which it is in fact leaning in the picture. A mere meaningful fitting in, after all, would allow many other possibilities: the ladder could lean against the second house or against a tree, or could lie beside a house, as it often does in villages, etc. Nevertheless, we intend to continue our experiments in the direction mentioned.

A second group of problems arising from these findings requires that we determine the precise conditions in which the "representations" will supplement the picture. Therefore we will have to consider not only the temporal factors—duration of exposure, influence of the interval between exposure and association test, etc.—but also the qualitative factors, what kind of things are noticed and what are unnoticed, the influence of the spatial position of the various components, etc.

To be sure, isolated observations in our experiments suggest that components that are alien to what was perceived may intrude. As an example, we will report one of Subject II's associations.

38. Shirt-Trousers, 1 second.

A shirt is hanging from an attic window; then somewhere, against the vague background of the village street, a clothesline is stretched, with several pieces of laundry hanging from it, white, sundrenched, and slightly lifted on the right by the wind.

It may be of interest to compare the reaction times of the associations which did contain supplementing components with those which did not. The averages are given in Table I.

TABLE I

			Subjects		
	I	II	III	IV	V
Reaction times of associations with supplementing components	4.5	1.1	0.8*	1.2	4.3**
Reaction times of associations without supplementing components	3.0	0.8	0.8	1.1	2.5

* [Judging by Table II, this figure is incorrect.—*Tr.*]

** [Judging by the discussion of this table, and by Table II, this figure is incorrect. It may be a misprint for 2.3.—*Tr.*]

Thus it appears that the reaction time of responses containing supplementing associations is longer than the reaction time of responses not containing supplementing associations in three subjects (I, II, IV), is the same length in Subject III, and is actually shorter in Subject V. No great significance can be attached to such averages, of course.

The range of the reaction times is given in Table II.

TABLE II

			Subjects		
	I	II	III	IV	V
Reaction times of associations with supplementing components	3—6	⅖—2	⅖—⅗	⅘—2⅕	1—4
Reaction times of associations without supplementing components	1⅕—3½*	⅖—2	⅕—5	⅖—3	1⅖—4

* [This figure could not have been arrived at with a ⅕ second stop watch.—*Tr.*]

In Subject II, there is no difference between the shortest reaction times to the associations with supplementing and nonsupplementing components. The difference in favor of nonsupplementing associations is not large in Subject III, is larger in Subject IV, and is striking in Subject I, whose shortest reaction time among the supplementing associations is twice as long as his shortest reaction time among the nonsupplementing associations. On the other hand, Subject V's shortest reaction time is among the supplementing associations. However, the longest reaction time is among the nonsupplementing associations of each subject, though Subject II's longest reaction time is the same in both groups.[1] Since the amount of data is limited, further statistical analysis of the reaction times is unwarranted.

It may be worth noting that, of the reaction times of the supplementing associations, 4 per cent lie above their average, while of the nonsupplementing, 29.8 per cent; of the supplementing, 66.6 per cent lie below their average, while of the nonsupplementing, 55.7 per cent; and that 33 per cent of the supplementing and 47 per cent of the nonsupplementing lie above the total average.

Thus, although the average reaction time of the supplementing associations is somewhat longer than that of the nonsupplementing ones, we do not find a concentration of long reaction times in the first group. On the contrary, abnormally long reaction times are rare in this group, as the small number of reactions of above-average length shows. In general, the distribution of reaction times above and below the average is the same in both groups, since the differences in the percentages are small considering the small number of experiments.

Before attempting to interpret our findings, we should like to mention parenthetically some incidental observations, so to speak, which support Allers's contention that image and reaction word are relatively independent from one another. Association 20 of Subject II is a good example: Yard-Moon, in which the pictorial "representation" has no connection whatever with the word "moon" but instead is connected with a different meaning of the stimulus word,[2] that is, farmyard (see also association 7 of Subject I).

In attempting to explain the facts described and the processes underlying them, we must consider the influence of the "task."[3] The subjects were instructed to report what they observed during the tachistoscopic exposure. There was a set[4] for verbal reporting, which would inevitably have come about even without the instructions, as it is obvious that without reporting, there can be no experiment. This set may, however, have determined the attitude to the exposure. There is presumably a difference between a set directed toward naïve perception and one directed toward subsequent reporting. Every set gives special weight to those elements which are "significant" in its terms.[5] With a set for reporting, the "namable," "word-near" components will be important (see Allers, 1922). Only the entirely strange is, strictly speaking, unnamable, the relatively unnamable being anything for which one cannot just then "find the right word." Each element has a different degree of "word-nearness." This set toward "word-nearness" of course need not actually be experienced any more than any other set.

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[1] [This statement disregards Subject V, whose longest reaction time is also in both groups, like Subject II's; and Subject I, whose longest reaction time is among the supplementing associations.—*Tr.*]

[2] [*Hof* means both "yard" and "halo around the moon."—*Tr.*]

[3] [*Aufgabe.—Tr.*]

Besides this factor, there are the factors which originate in the picture. Certain elements are perceived by all subjects; they obtrude on apperception. In part they may be intrinsically conspicuous (for instance, the light wall of the first house), and in part they may owe their obtrusiveness to their word-nearness.

A further effect of the experimental situation was that the subjects naturally realized the connection between the tachistoscopic exposure and the subsequent association experiment. It would have been purposeless and futile to try to mislead them. This seems to explain why the visual memory of the picture appeared in so many associations. Moreover, the unfamiliar situation in front of the tachistoscope may well have made these memories particularly obtrusive. These factors are not of much importance, however, because the question is not how these memories intruded between the stimulus and the reaction word, but how apparently unperceived components could emerge in this way.

The selection of what is perceived during exposure is always determined by a definite "direction of interest." This interest may be reactive, imposed by the obtrusiveness of a picture component (for instance, particular brightness), or it may be active, stemming from a pre-established set. One might speak of expositional and

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[4] [*Einstellung.—Tr.*]

[5] In the case of tachistoscopic exposure of colored dots and instructions to count all the blue dots, all the others will appear simply as "not blue," withou differentiation into red, green, etc., whereas without such instructions the diffe ences in color will be noticed and grasped.

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not tend toward verbal formulation to the same extent as do the
other components: they are relatively word-distant.[8]

Once a thought which has become concrete has attained a verbal
formulation, even if it is only a preliminary one, its incidental
elements recede entirely and can be forgotten, even if they have
somehow contributed to bringing about the final result. We believe
that the situation in our experiments is similar. We assume that
here, too, the word-near elements come to the fore under the influ-
ence of the instructions, while the word-distant elements remain in
the "sphere" but nonetheless in consciousness. They are simply not
"important" to us for our task and are therefore neglected. But
they are neither superfluous or done away with, like the analogous
happenings in thinking, for the reason that they had no task to
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A further effect of the experimental situation was that the subjects naturally realized the connection between the tachistoscopic exposure and the subsequent association experiment. It would have been purposeless and futile to try to mislead them. This seems to explain why the visual memory of the picture appeared in so many associations. Moreover, the unfamiliar situation in front of the tachistoscope may well have made these memories particularly obtrusive. These factors are not of much importance, however, because the question is not how these memories intruded between the stimulus and the reaction word, but how apparently unperceived components could emerge in this way.

The selection of what is perceived during exposure is always determined by a definite "direction of interest." This interest may be reactive, imposed by the obtrusiveness of a picture component (for instance, particular brightness), or it may be active, stemming from a pre-established set. One might speak of expositional and dispositional factors. Expositional factors probably played a minor role, but it was very likely an expositional factor that caused the lighter house to be seen almost every time.

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[4] [*Einstellung.—Tr.*]

[5] In the case of tachistoscopic exposure of colored dots and instructions to count all the blue dots, all the others will appear simply as "not blue," without differentiation into red, green, etc., whereas without such instructions the differences in color will be noticed and grasped.

The subjects were instructed to notice as much as possible; even so, Subjects III and V saw very few details. It seems unlikely that "unconscious determining" tendencies and symbols had any influence here. Pötzl has pointed to similarities between the kind of phenomena discussed here and indirect vision. However, $\frac{1}{100}$ second is time enough for the eyes to wander. The fact that occasionally elements were perceived which, if the subject were focusing on the first house (which was almost always seen), would have fallen in the region of peripheral vision and should therefore have been indistinct, shows that eye movements did occur. On the other hand, elements which fell in the region of direct vision were sometimes not perceived. Nor do the picture components that emerged in the "supplementing representations" show any signs of having been peripherally perceived. Indirect vision will not do as an explanation here.

The unnoticed components appear almost exclusively in the "representations"; hardly ever do they reveal themselves in the reaction words. (For the independence of the verbal process from the pictorial, see Allers, 1922.) The connections between the stimulus word and the "supplementing representation" are sometimes very loose and far-fetched. Apparently the unnoticed components have a special readiness to emerge.

Two questions arise: (1) In what fashion do the unnoticed elements "exist" so that they are able to emerge? (2) What laws control the emergence of the "unnoticed"?

At the second exposure of the picture, all subjects except Subject III discovered the elements of the "representations" without a "quality of familiarity." Subjects II and IV were particularly surprised by the close correspondence between "representation" and original. Subject III said that he "recognized" the picture components, although he did not remember seeing them at the first exposure.[6] Here we have the behavior of the other subjects in an accentuated form: they too must somehow have perceived the "unnoticed." If the "unnoticed" could push into the "supplementing representations," one would have thought it would also be able to elicit a "quality of familiarity."[7]

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[6] It is unlikely that he confused exposure with representation, since he was trained in experimental self-observation.

In speaking of the "unnoticed," we must admit the possibility that we may be dealing with things that were noticed but immediately forgotten. It would be strange, however, if all subjects should forget almost the same things: it would be more plausible to say that these components were perceived without becoming conscious. But only when every other explanation fails should "unconscious" mental factors be assumed, regardless of one's general view of the meaning and justification of this concept. We assume that the "unnoticed" is in fact "noticed" but belongs to the realm which Schilder calls the "sphere," in which many as yet little-known phenomena undoubtedly occur. We do not know them, or rather, do not pay attention to them, partly because we have no name for them. Subjects instructed to react in words are set to give a word-near response: only such a response fits the schema with which the subject approaches the exposure. Word-nearness is either enforced by expositional factors, or is present or absent depending on the accidental situation or on permanent structural conditions.

But the processes underlying awareness of objects are not only verbal. In everyday thought processes, as well as in purposeful scientific thinking, there intrude among the formulated or formulable components a great number of others, some of which, under favorable conditions, can be captured, although they do not have a place in the formulated end products of thought. Obviously we must assume that something like this happens in our case too. Even in abstract thinking, pictorial elements often play a part. As a rule they remain unnoticed; a special set and special training in the apperception of these apparently unimportant and fleeting elements are necessary in order to ascertain their presence, and more, to recognize what their content is. They are by no means unconscious; they do not lack the quality of consciousness. What distinguishes them is that they are or seem to be unimportant for the thought of the moment. They do not carry meanings which seek to take concrete shape in the current thought process, and therefore they do not tend toward verbal formulation to the same extent as do the other components: they are relatively word-distant.[8]

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[7] [The discussion in this paragraph is rather confusing. As for the first sentence, if any subject was an exception to the general absence of a "quality of familiarity" in the subjects, it was Subject I. As for the second sentence, the authors report nothing about Subject IV's reaction to the second exposure, and what they say here about it would apply rather to Subject V.—*Tr.*]

Once a thought which has become concrete has attained a verbal formulation, even if it is only a preliminary one, its incidental elements recede entirely and can be forgotten, even if they have somehow contributed to bringing about the final result. We believe that the situation in our experiments is similar. We assume that here, too, the word-near elements come to the fore under the influence of the instructions, while the word-distant elements remain in the "sphere" but nonetheless in consciousness. They are simply not "important" to us for our task and are therefore neglected. But they are neither superfluous or done away with, like the analogous happenings in thinking, for the reason that they had no task to fulfill. We believe that the elements in the "sphere" are forgotten only when, with the formulation accomplished, their real or potential role has been played. As long as the formulation, or at least its schema, has not been found, the elements in the "sphere" are not superfluous: first, because any of them may come to play a role in the process of concretization; second, because their totality, serving as "background-consciousness," provides the special nuances of the clear, central experiences.[9] We admit that this formulation implies a far-reaching hypothesis, based on fundamental assumptions about the nature of mental structures. We believe, however, that this view can at least serve as a working hypothesis, even if one does not want to accept its more far-reaching implications.

There is no need to assume that "unconscious" factors in any other sense play a part here. The reaction times, among other things, speak against the "determination by complexes" of the selection of what is perceived. If "not noticing" were determined by complexes, then the reaction time should be prolonged on those associations which are accompanied by supplementing representations. This is not the case (p. 144): only 33 per cent of the reaction times of supplementing associations lie above the average, as against

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[8] See Hoenigswald (1921) on the relations between thought and expression. "Word-nearness" and the relationship between expression and thought have nothing to do with Freud's surely erroneous proposition that object representations appear in consciousness only when connected with verbal presentations.

[9] For instance, the nuances of plausibility or improbability, hopefulness, decisiveness, etc., i.e., all those nuances we want to express when we say, for instance, "I do not—or do not yet—know why, but the solution seems to lie in this direction."

44 per cent[10] of the reaction times of nonsupplementing associations. Nor is there a disturbance in reproduction.

In many respects our results agree with Pötzl's. They differ in that the originally distinctly perceived components of the picture do not appear in his subjects' dreams, while they always appear in our subjects' "representations." Pötzl refers to Freud's theory of dreams and to the occurrence of afterimages richer in details than the originals, as well as to the "hypnagogic development of visual situations that have penetrated [the mind] preconsciously" (p. 115) and to the subsequent visual development in eidetic images. He concludes: ". . . there exists a relationship of exclusion, owing to which whatever has been mentally formed as a Gestalt is excluded from subsequent development, so that only parts of the original excitation can develop, and whatever has developed into a Gestalt loses the power to act further" (p. 117).[11]

In our experiments, the distinctly perceived picture components are not absent from the "representations." On the contrary, the supplementing components usually appear in the framework of the originally perceived material. But we do not infer from this an essential difference between waking- and dream-consciousness, which is not, in our opinion, as far-reaching as is sometimes assumed. It is possible that the differences between Pötzl's and our observations are partly due to his considerably shorter time of exposure.

Urbantschitsch (1907) has observed that eidetic images are similarly supplemented. "The memory image frequently supplies missing parts of the visual object. Such completions take place either unconsciously, in that the subject believes that he actually saw in the visual object the element which emerged only in the memory image, or else the memory image at first shows the actual deficiency of the visual object quite accurately, but later supplies the missing part, even if the subject strives to preserve his actual visual impression. Thus, for instance, one subject distinctly saw the complete heads of the two . . . horses in the memory image, although they were not in the picture" (p. 94).

This is the result of a tendency toward meaningful completion, whereas in our experiments the insertion of components at the right place in the picture was not determined by a meaningful relationship (e.g., the position of the ladder cannot be explained as "meaningful").

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[10] [This figure was previously given as 47 per cent.—*Tr.*]

[11] Some other time I hope to discuss the extent to which Pötzl's opinion is in agreement with our basic views.

The similarity of our findings to other observations of Urbantschitsch is greater. "Occasionally an initially unconscious impression reaches consciousness only in the memory image, and thereafter we remember that we have seen or heard it before, although we were not aware of it until then" (p. 98). But here there is also an essential difference: in our experiments the quality of familiarity was absent; our subjects just did not remember.

SUMMARY

1. Elements which are missing in the description of the picture after tachistoscopic exposure appear in the form of images ("representations") elicited by appropriate stimulus words during associations.
2. They often appear in a form which corresponds to the actual picture both spatially and qualitatively.
3. They are not recognized by the subjects as parts of the picture. In fact, the subsequent objective recognition of their agreement with the picture often causes surprise.
4. The reaction times of the supplementing associations do not differ from the reaction times of the nonsupplementing associations.
5. We believe that these components are not "unconsciously" present but exist as particular givens within the "sphere." Repression does not determine the selection of what is perceived.
6. On the contrary, we believe that the factor of "word-nearness" and the influence of the instructions in the experiment are the decisive, although not necessarily the only, determiners of this selection.

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RUDOLF ALLERS received his M.D. from the University of Vienna, his Ph.D. from the University of Milan. He was reader in psychiatry at the Medical Schools of Munich and Vienna, 1913-1937, and a practicing psychiatrist. From 1938-1948 he taught philosophical psychology at the Catholic University. Since 1948 he has been Professor of Philosophy at Georgetown University, Washington, D.C., now emeritus but reappointed.

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Dr. Pötzl's best-known work was done on aphasia, apraxia, and agnosia. He is at present professor emeritus.

JAKOB TELER: No information was obtainable other than this brief remark in a personal communication from Dr. Allers: "At the time when Jakob Teler worked under me [in Vienna], he was still a student of medicine. So far as I recall he was a Hungarian and went back to Hungary to complete his studies."

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